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BONE CHANGES RESULTING FROM EXPERIMENTAL ORTHODONTIC TREATMENT

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IN CONSIDERING any orthodontic treatment, especially by means of appliances, we should try to prognosticate the resultant good or ill effects of such treatment. In other words, it is important not only to have a complete history of the case and an accurate diagnosis but also to visualize all the effects of our treatment. These effects should be considered from three different aspects.

1. The Mechanical Aspect

A mechanical analysis of any appliance seems an obvious necessity. Nevertheless it seems worthwhile to mention it, since many appliances have become extensively employed because they happened to prove successful in many cases. A better understanding of the mechanical principles of appliances used might frequently improve or modify their design.

2. The Biologic Aspect

It would be wrong to consider the patient's teeth and jaws as a lifeless mechanical model, and we must, therefore, have a thorough understanding of what is taking place in the tissues during active treatment.

3. The Systemic Aspect

In planning treatment the systemic condition of the patient must be considered in order to relate it to the treatment.

This paper will discuss some tissue changes obtained in experimental procedure and will attempt to explain these changes wherever possible in terms of mechanical forces.

Tissue changes in orthodontic treatment concern chiefly the hard tissues because these are generally much more easily influenced than are the soft tissues. Of these hard tissues, the bone is chiefly affected. The question of how changes in the shape of a bone may occur can today be considered as entirely clarified. *Resorption of bone and deposition of new matrix, which subsequently calcifies, are generally accepted as the only means of changing the*

shape of a bone. The changes in the immediate vicinity of the teeth, that is, in the surrounding structures, which result from the moving of teeth are well understood at present. Sandstedt[1] was the first, in 1904, to describe the occurring changes around experimentally moved teeth, and in 1911 Oppenheim[2] in Vienna published a series of pictures obtained from experiments with monkeys, which became the basis of our conception of this problem. Stuteville,[3] Johnson, Appleton, and Rittershofer,[4] Marshall,[5] Orban and Gottlieb,[6] Kronfeld,[7] Schwarz,[8] and others published similar findings. All these investigations, however, dealt with changes in the alveolar process. The question as to how and to what extent simultaneous bone changes due to orthodontic treatment occur in other parts of the skull was not the subject of any experiments, although various opinions about these changes were expressed. I have performed a series of experiments on monkeys in order to study these changes in other parts of the skull and have obtained some interesting facts.[9] The experiments should not, however, be considered as final. On the contrary, they give us only a hint as to what direction further experimentation should take.

METHODS AND MATERIALS

Macacus rhesus monkeys were used for the experiments because of their similarity to man in the structures of the joint and the pattern of the teeth. The apparatus were designed to resemble as closely as possible those used in clinical practice.

I. INTERMAXILLARY RUBBER BANDS PULLING THE MANDIBULAR ARCH ANTERIORLY

The first experiment was performed to establish the bone changes that occur in pulling the mandible forward by means of intermaxillary rubber bands. A young animal of about 18 months was used. The permanent incisor teeth and first molar teeth were erupted and in occlusion, but the deciduous canine and molar teeth were still firm. The appliances used in this experiment were constructed as follows:

In the mandibular denture thin metal caps were cemented on the teeth of both buccal segments, from first molar to canine teeth on both sides. To the metal caps buccal tubes were soldered to support an arch wire which touched the incisor teeth and was ligated to them. Small hooks for the rubber bands were soldered to the sides of the metal caps in the region of the first molar teeth.

In the maxillary denture thin metal caps were cemented on all buccal teeth in a similar way. Buccal tubes were placed on the caps to support an arch wire which, however, did not touch the anterior teeth. Hooks were placed in the canine region of this arch wire, but the incisors were not ligated.* The animal wore this apparatus together with rubber bands (cut from rubber-dam) for eighty-two days. The rubber bands were removed only during feeding and were renewed daily. A muzzle was used to prevent the animal from removing the elastics. After eighty-two days there was a noticeable mandibulary pro-

*This appliance opened the bite slightly. Similar appliances which also opened the bite were constructed for other animals but did not produce the same bone changes as will be shown. Neither were these bone changes to be found in control animals.

traction (Class III relation), and the animal was sacrificed. All the alveolar processes, both temporomandibular joints, and the region at the angle of the mandible were examined histologically. Corresponding structures of a control animal which had not been subjected to any treatment were also prepared and examined to rule out false interpretation of the findings.

Findings in the Experimental Material.—

A. Head of the condyle and glenoid fossa

A sagittal cut of the joint in low power is reproduced in Fig. 1 for orientation. The joint of the monkey closely resembles the human joint. In Fig. 2 and Fig. 3 (enlarged) new bone trabeculae are shown on the posterior side of the glenoid fossa and also on the posterior side of the ascending ramus and head of the condyle. These trabeculae are laid down about anteroposteriorly, or in line with the pulling force, and are lined by osteoblasts covering a layer of uncalcified matrix.

Fig. 1.—Sagittal section through a temporomandibular joint of a *Macacus rhesus* monkey. *A*, Disc in the glenoid fossa. *B*, Head of the condyle. *C*, External pterygoid muscle. *D*, Mandibular canal.

Fig. 2.—Glenoid fossa. *A*, Deposition of new bone. *B*, Cartilage on the head of the condyle. *C*, Bone resorption (See Fig. 4).

Another picture taken of the same section (Fig. 4) shows active resorption on the anterior wall of the articular fossa. Resorption is also evident on the corresponding anterior side of the condyle as seen in Fig. 5.

The first conclusion to be drawn from the pictures of the glenoid fossa (resorption in the anterior and deposition in the posterior region) is that there must be a migration forward of the fossa. Since the head of the condyle remains in the fossa, the mandible also must be comparably displaced and, in the way, a change occurs in the relation of upper and lower teeth.

The activities taking place in the head of the condyle (deposition posteriorly and resorption anteriorly) increased the distance from the symphysis of the mandible to the head of the condyle as the mandible moved forward.

B. Angle of the mandible

Processes at the angle of the mandible are noted which would indicate an eventual change in the form of the mandible. Marked resorption is shown at

Fig. 3.—Posterior side of the head of the condyle. *A*, Bone deposition in the glenoid fossa. *B*, Bone deposition on the condyle posteriorly. *C*, Cartilage.

Fig. 4.—High magnification of part of the anterior wall of the fossa. *A*, Giant cell (osteoclast) as evidence of bone resorption. *B*, Articular disc.

the posterior edge whereas the anterior margin shows deposition of new bone (Figs. 6 and 7). Such changes are apt to produce a widening of the angle. Since the condyle retains its position in the fossa, this change also results in a forward movement of the lower dental arch. Resorption of the trabeculi is noted on the side toward the outer cortical plate and apposition on the side toward the bone marrow, indicating constant reformation (Fig. 7). The widening of the angle in correcting mandibular distoclusion would agree with the

Fig. 5.—Anterior side of the head of the condyle. *A*, Cartilage. *B*, Osteoclast in Howships lacuna. *C*, External pterygoid muscle.

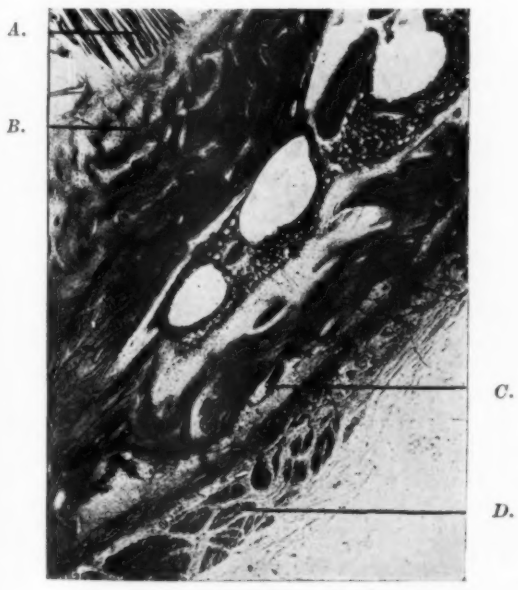


Fig. 6.

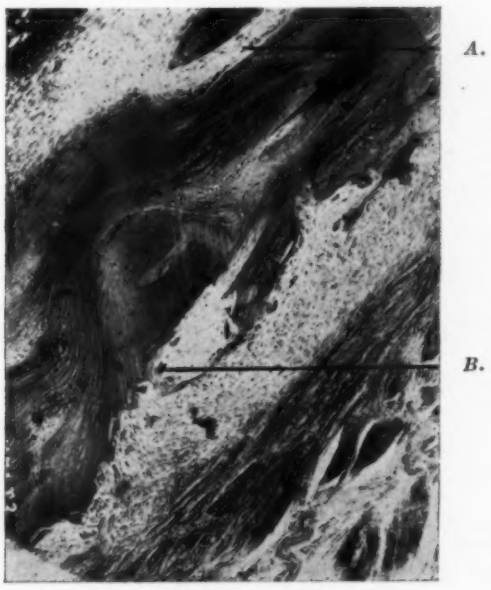


Fig. 7.

Fig. 6.—Angle of the mandible. *A*, Internal pterygoid muscle. *B*, Bone deposition. *C*, Bone resorption (See Fig. 7). *D*, Masseter muscle.

Fig. 7.—High power magnification of part of Fig. 6. *A*, Bone deposition (osteoblasts) toward the bone marrow. *B*, Giant cell (osteoclast) on the outer border of the angle.

findings of Hellman, Waldron, Sicher and Krasa that the angle in such abnormal cases usually is found to be more acute than normal.

C. Changes around the mandibular teeth

Definite changes are also noted in the alveolar bone surrounding the mandibular teeth. Osteoblastic lining is seen on the sides of tension, while the side of pressure shows osteoblasts all along the roots (Fig. 8 and Fig. 9). The bone spicules are lined up parallel but not quite horizontally. They are seen to be in a slightly mesioapical direction. This is probably due to the fact that occlusal stress was increased by the raising of the bite. We must remember that the teeth, in wearing caps which slightly opened the bite, were depressed as well as moved mesially by means of the rubber bands. The remarkable amount of tooth movement is shown by the fact that the septa between the teeth are entirely of new bone.

Fig. 8.

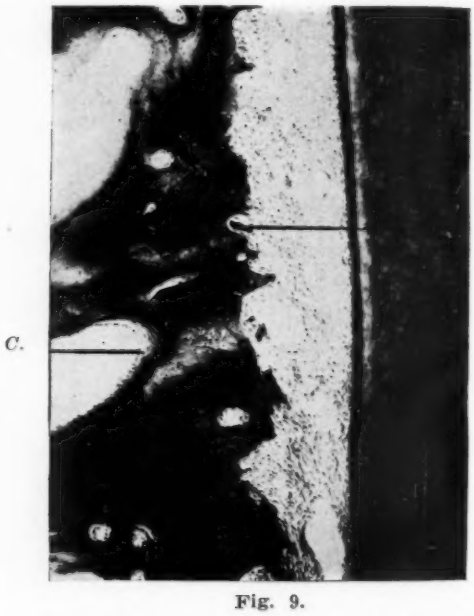


Fig. 9.

Fig. 8.—Interalveolar septum. *A*, Bone resorption. *B*, Osteoblastic lining (bone deposition).

Fig. 9.—Higher magnification of an interalveolar septum. *A*, Tooth. *B*, Osteoclast. *C*, Osteoblastic lining.

D. Changes around the maxillary teeth

Here some evidence was noted that the maxillary teeth had moved distally, but this evidence was not significant.

Fig. 10 shows the anterior side of the condyle of a control animal, and in Fig. 11 the posterior side of the condyle is reproduced.

II. JUMPING THE BITE

The purpose of the next experiment was to determine whether variations could be noted in the use of different therapeutic means for effecting the mesial displacement of the mandibular dental arch. In this experiment an effort was made to move the mandible forward by means of an endogenous instead of an exogenous force, i.e., by muscular force instead of rubber bands. Such a possibility lies in the therapy of "jumping the bite" as introduced in 1880 by

Kingsley. Bite raising caps were cemented upon all the canine and molar teeth of the mandible and maxilla of a young Rhesus monkey. These caps eliminated the normal inclined planes of the teeth and forced the mandible forward in order to establish central occlusion. No other force was used, and the animal was sacrificed forty-six days after the caps were cemented. All of the capped teeth as well as the joint and the angle were subjected to the same histologic examination as in the first experiment.

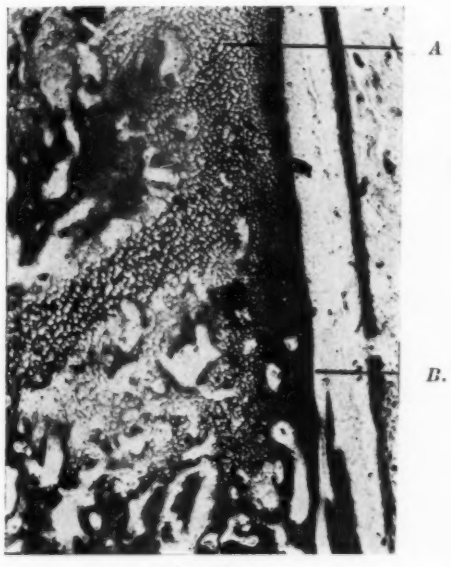


Fig. 10.

Fig. 11.

Fig. 10.—Anterior side of the condyle of a control animal. *A*, Cartilage. *B*, Bone.

Fig. 11.—Posterior side of the condyle of a control animal. Note the more vertical direction of bone trabeculae, *A*.

Fig. 12.

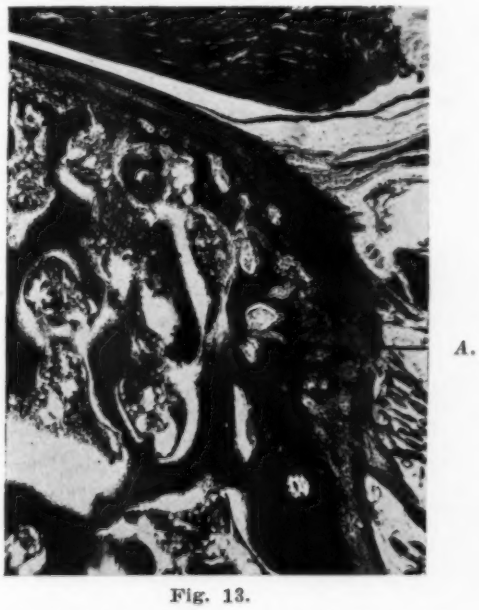


Fig. 13.

Fig. 12.—Temporomandibular joint of a monkey obtained in Experiment II. (Jumping the Bite). *A*, Bone deposition on the posterior wall of the glenoid fossa. *B*, The same on the posterior side of the condyle. *C*, Resorption on the anterior side of the condyle.

Fig. 13.—Higher magnification of the region marked *C* in Fig. 12. *A*, Resorption of bone.

Findings in the Experimental Material.—

A. Changes in the glenoid fossa and condyle

As in the former experiment we find deposition of bone at the distal side of the articular cavity and resorption at the mesial (Figs. 12, 13, 14, and 15). At the condyle also we find a similar picture as before, i.e., deposition on the distal side and resorption at the mesial. Thus it can be stated that this form of therapy had an effect similar to that obtained from wearing intermaxillary rubber bands, although important differences will be shown. All of the described changes, however, were less marked. This was probably due to the shorter duration of the experiment.

B. Changes at the angle

Marked resorption at the apex of the angle is noted (Fig. 16) indicating widening of the angle. These changes are analogous to those shown in the former experiment.

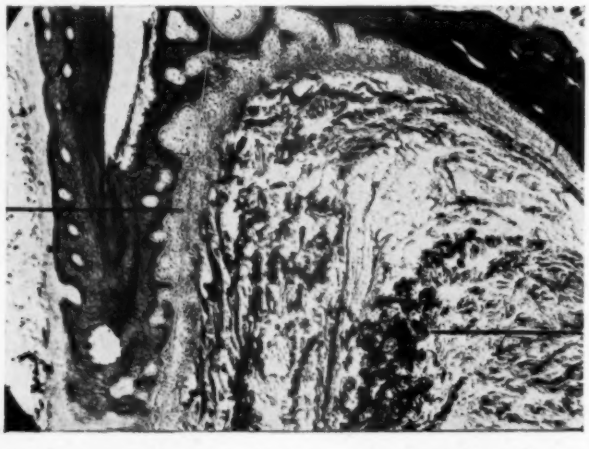


Fig. 14.—Higher magnification of the glenoid fossa. *A*, Deposition of new bone. *B*, Articular disc.

C. Changes around the teeth

The changes noted in the alveolar bone are of great importance to the evaluation of the experiment. Appreciable differences between the changes occurring in this experiment from the ones in the previous experiment are noted. The alveolar septa in the bifurcation of the mandibular molar teeth are markedly destroyed. The peridental membrane along nearly half of the distal root of some of the permanent and deciduous teeth appears crushed so that tooth structure and bone are in contact with each other. This is a picture of extreme traumatic changes (Fig. 17). Extensive hemorrhages are to be found in the peridental membrane.

Fig. 18 shows the interdental septum between the mandibular second deciduous and first permanent molar teeth. We see marked destruction of the crest of the alveolar process apparently due to an injury caused by the caps.

The photomicrographs of the maxillary teeth in this case show similar changes. Pictures of severe traumatic occlusion could be found in the bifurcation of permanent molars as well as in the inter-alveolar septa.

III. DISTAL DISPLACEMENT OF THE LOWER ARCH BY MEANS OF INTERMAXILLARY RUBBER BANDS

The purpose of this experiment was to remove any error that might have arisen in the first two. Although the control animal and photomicrographs obtained from other animals did not show comparable findings, the bone changes still could be attributed to the possibility of normal growth changes or anomalous

Fig. 15.

Fig. 16.

Fig. 15.—Higher magnification of region *B* of Fig. 12. *A*, Bone deposition.

Fig. 16.—Region at the angle of the mandible obtained in Experiment II. *A*, Bone resorption. *B*, Bone deposition.

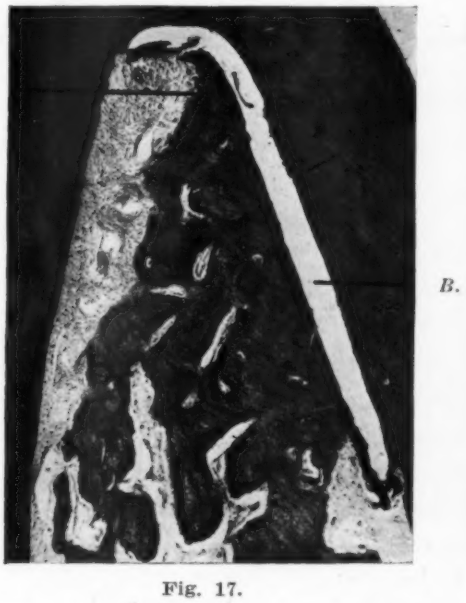


Fig. 17.

Fig. 18.

Fig. 17.—Bifurcation of a molar tooth after jumping the bite. *A*, Bone resorption. *B*, Complete destruction of peridental membrane.

Fig. 18.—Interalveolar septum. *A*, Resorption on the crest.

variable factors. In order to eliminate these possibilities, the mechanics of the treatment were completely reversed. It was necessary to determine whether the response of tooth structure and bone to given forces is universal.

As in the first experiment, cast metal caps were cemented on all posterior teeth including the canine of a young Rhesus monkey. In the maxilla these caps were connected by a wire of 1 mm. diameter which closely fitted the front teeth. The entire upper arch was therefore included in the anchorage which was stationary in the posterior area and simple in the region of the incisors. Hooks were placed in the molar region. In the mandible a labial arch was fixed to the caps in buccal tubes at the molar region. This arch had hooks at the canine areas. The mandibular incisors were not included in this arch adjustment. In other words, the appliances used for the maxilla and mandible of the first animal were reversed in this experiment. Light rubber-dam bands exerting a force in the direction opposite that of the first experiment were used according to Class III treatment, and the animal was sacrificed after seventy-two days. The procedure followed was the same and the corresponding bone areas were examined histologically. X-rays of the skull were taken before histologic preparation showing the clinical findings (Fig. 19). A marked distoclusion of the mandible is noted in the canine and molar regions.

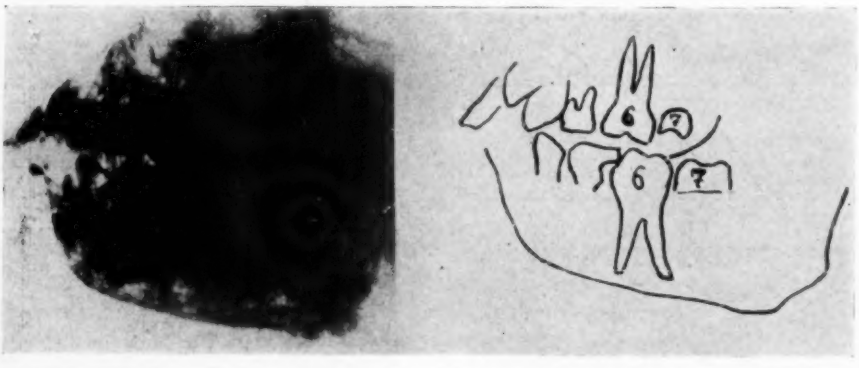


Fig. 19.—X-ray of a monkey skull showing Class II jaw relations due to orthodontic treatment.

Findings in the Experimental Material.—

A. Changes in the glenoid fossa and condyle

An examination of the temporomandibular joint shows no parallel arrangement of bone trabeculae on the distal side such as was clearly seen in the former experiments. On the contrary, we find giant cells indicating resorption in the lacunae (Fig. 20). The posterior bony process of the fossa shows resorption on the side toward the condyle and deposition of new bone arranged in horizontal parallel layers on the side away from the condyle (Fig. 21). Growth of new bone is also visible on the mesial side of the fossa and of the condyle (Fig. 22). All of the findings of the former experiment are exactly reversed and allow the conclusion that the glenoid fossa is in a state of distal migration. The condyle, in moving forward, reforms to adapt itself to the new position. The distance to the chin is thereby shortened.

B. Changes at the angle

The changes at the angle also are noteworthy in that deposition of bone is now to be seen at the apex (Fig. 23), whereas in the previous experiments evidence of definite resorption was presented. New osseous trabeculae in parallel arrangement are seen at the outer border of the angle and considerable resorption on the side of the bone marrow. This would indicate that the angle is becoming more acute.

Fig. 20.—Posterior side of the condyle. *A*, Osteoclast in lacuna. (Experiment III.)

Fig. 21.

Fig. 22.

Fig. 21.—Posterior boundary of the glenoid fossa. *A*, Bone deposition. *B*, Resorption on the posterior wall of the fossa.

Fig. 22.—Anterior side of the condyle. *A*, Osteoblastic lining. *B*, External pterygoid muscle. *C*, Articular disc.

C. Changes around the teeth

The findings in the alveolar bone show changes directly opposite those seen in the former experiments. These changes indicate distal movement of the mandibular teeth (Fig. 24) and mesial movement of the maxillary molar teeth (Fig. 25). In Fig. 26 a higher magnification of the septum as seen in Fig. 24 is photographed.

Fig. 23.—Angle of the mandible. *A*, Bone deposition. *B*, Resorption toward the marrow.

Fig. 24.—Lower molars moved in the direction indicated by the arrow. Region *A* enlarged in Fig. 26.

IV. RAISING THE BITE BY PLATES OR SIMILAR DEVICES

This experiment was performed to show whether, where, and to what extent raising the bite, especially in the anterior region alone (as used in bite plates in treatment), would produce changes in the bone.

Since it is impossible to use a removable bite plate on monkeys, a cemented metal cap on the maxillary six anterior teeth was applied. In this way, only the anterior teeth could occlude. Thus the cap acted like a bite plane as far as the mandible was concerned (Fig. 27). After forty-nine days the maxillary and the mandibular posterior teeth were again in occlusion. The animal was sacrificed at this time, and the usual histologic examination was performed.

Findings in the Experimental Material.—

Fig. 25.—Maxillary molars moved in the direction indicated by the arrow.

A.

B.

Fig. 26.

Fig. 27.

Fig. 26.—Interalveolar septum. Enlarged from Fig. 24. *A*, Resorption. *B*, Apposition.
Fig. 27.—Diagram of appliance used in Experiment IV.

A. Changes at the condyle and glenoid fossa

Changes similar to those in Experiment I could be found. Fig. 28 presents a low-power magnification. Apposition may be seen at the posterior side of the condyle and in the depth of the glenoid fossa. But there is an important difference noted from that seen in the first experiment. Apposition in the fossa extends not only on the distal side of the fossa but also in its depth. The

bone trabeculae are arranged more vertically, and there is no resorption on the anterior side of the fossa. These changes evidence not so much the forward migration of the fossa as they do its shallowing (Fig. 29).

As regards the condyle there is little difference between the findings obtained in this and the first experiment. We find apposition on the posterior side (Fig. 30) and resorption on the mesial side of the condyle (Fig. 31). The conclusion seems justified that the condyle is growing posteriorly, thus changing the shape of the mandible. The newly formed bone trabeculae, however, are arranged more vertically than in the first experiment. The condyle apparently is growing distocranially.

B. Changes in the angle

Resorption again is noted on the tip of the angle and at the inferior mandibular margin. On the ascending ramus of the mandible we find apposition. These changes indicate the development of a more obtuse angle (Fig. 32).

Fig. 28.

Fig. 29.

Fig. 28.—Temporomandibular joint after Experiment IV. *A*, Bone deposition in the fossa. *B*, Bone deposition at the posterior side of the condyle. *C*, Resorption at the anterior side of the condyle. (Compare with Figs. 2, 3, and 5.)

Fig. 29.—Higher magnification of region *A* in Fig. 28.

DISCUSSION

All of the experiments demonstrate that normal occlusion may be altered artificially by appliances. They also demonstrate that bone changes may occur simultaneously in various regions.

The histologic pictures cannot be taken as any indication of the amount of actual growth or destruction. They show merely the region where changes occur and the quality of such changes. Whether or not changes may be controlled in specific areas by means of appliances has not been established by these experiments. Generally the idea seems to be well founded that the relation between the degree of the applied force and the resistance of the anchorage might produce bone changes varying in degree at given localized areas. If, for instance, an

anchorage is not rigidly fixed, permitting the anchored teeth some degree of tilting, intermaxillary forces will certainly produce more direct movement of the teeth themselves. In this way normal occlusion will be achieved before appreciable changes in the joint and angle could occur. In other words, a given force might act to produce bone changes in the alveolar process varying in degree according to the appliance used. The period of duration of treatment and the effect upon the joint may thus be varied. Whether or not forces which produce changes in the alveolar bone varying in degree proportionate to the degree of intensity of the force will also affect the temporomandibular joint and angle in a similar way remains to be studied.

Experiment I. (Intermaxillary rubber bands as applied in Class II treatment).—Changes in the occlusion occurred as the result of the following bone changes: The mandibular teeth, including the alveolar processes, were moved

Fig. 30.

Fig. 31.

Fig. 30.—Higher magnification of region *B* in Fig. 28.
Fig. 31.—Higher magnification of region *C* in Fig. 28.

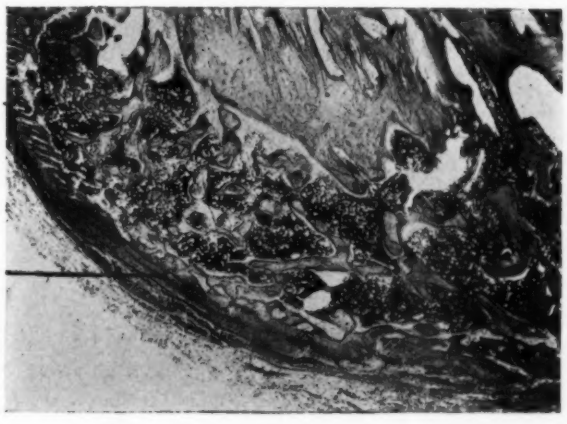


Fig. 32.—Angle of the mandible in Experiment IV. *A*, Bone deposition. *B*, Resorption.

forward (Fig. 33 *d*). The maxillary teeth, including the alveolar processes, were moved backward (Fig. 33*c*). The changes in the fossa indicate forward migration of the fossa in the skull. This would result in bringing forward the mandible without producing any changes in it (Fig. 33*e*). Changes in the shape of the mandible have been found at the following regions:

a. The condyle and the neck grow upward and in dorsal direction. Thus the distance from the condyle to the symphysis is increased resulting in a more mesial occlusion of the mandibular teeth (Fig. 33*f*).

b. The angle of the mandible is widened. This results also in an increased distance from condyle to symphysis resulting in a mesioclusion of the mandibular teeth (Figs. 35 to 37).

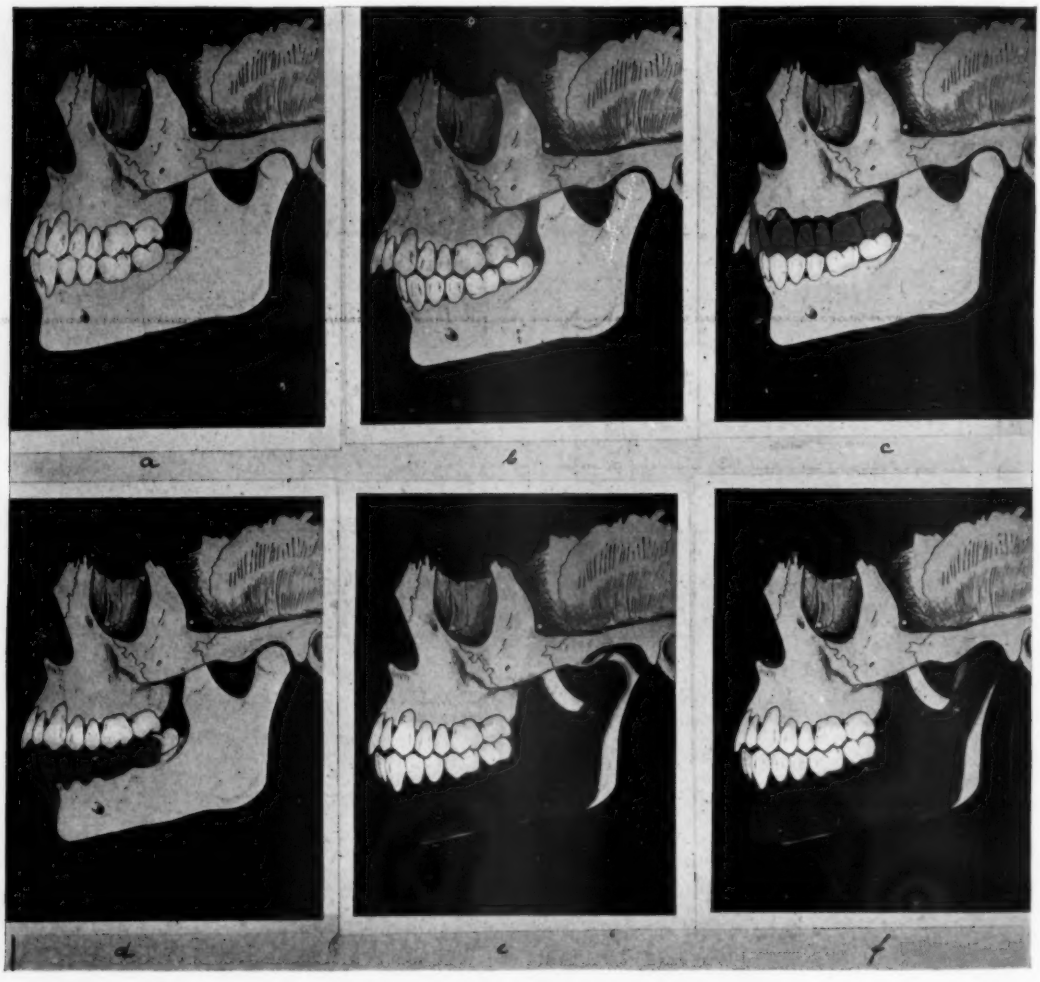


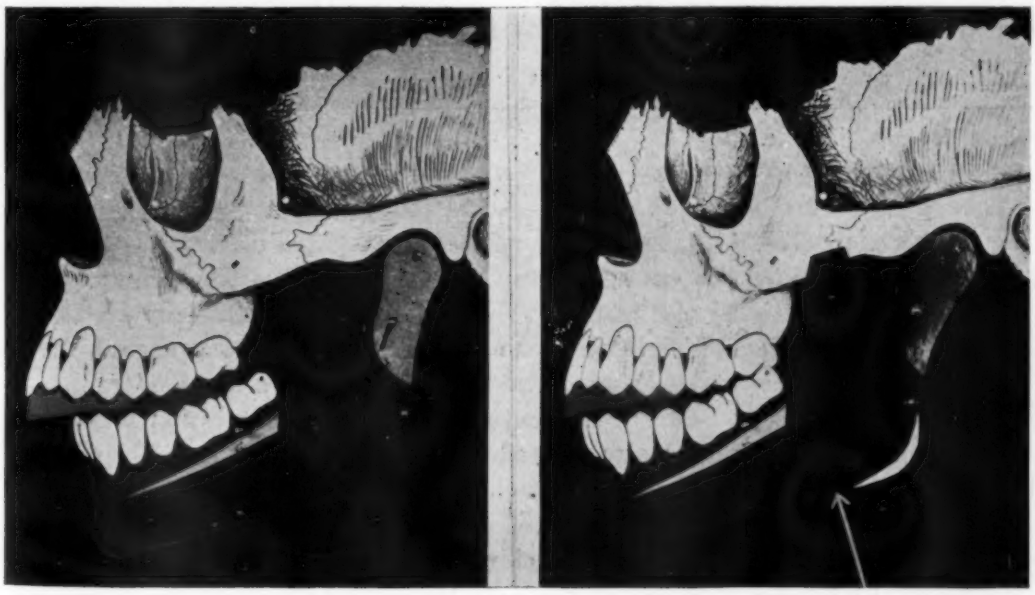
Fig. 33.—Photographs of a demonstration model: *a*, In normal occlusion. *b*, In Class II malocclusion. *c*, Corrected occlusion by movement of maxillary teeth from their alveoli. *d*, Corrected occlusion by movement of mandibular teeth from their alveoli. *e*, Corrected occlusion by reorientation of the glenoid fossa, without change in the shape of the mandible. *f*, Corrected occlusion by reorientation of the head of the condyle. (The described changes take place simultaneously.)

Experiment II. (Jumping the Bite).—As to this experiment, we must remember that no exogenous force was applied. The contention that forces applied on tissue of lower animals may produce reactions different from those pro-

duced in man by means of similar forces cannot be valid in this experiment where only endogenous stimuli were applied. By endogenous stimuli we imply that the balance between muscular action and bone is disturbed. Therefore the results of the "jumping the bite" experiment may be applied quantitatively also for human beings. The experiment has shown that the applied treatment could produce bone changes at various areas similar to those effected by intermaxillary rubber bands (joint, condyle, angle, and alveolar bone). The im-

A. *B.*

Fig. 34.—Model demonstrating the action of the sphenomandibular ligament represented by a string. Opening of the mouth is possible only with simultaneous forward movement of the condyle *B*.

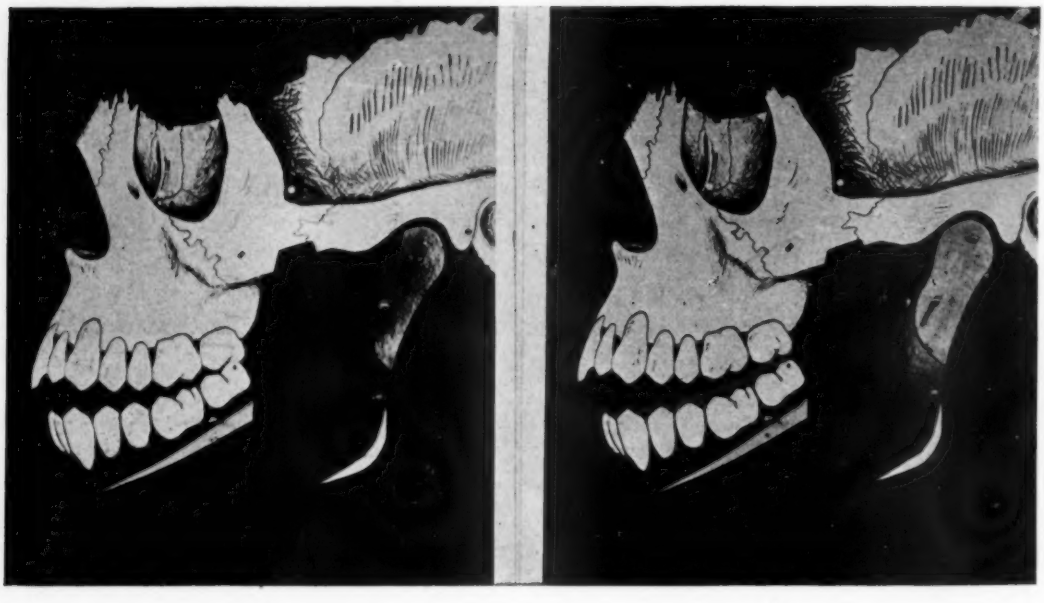


A. *B.*

Fig. 35.—Bite plane inserted *A*. Muscular action indicated by the arrow produces widening of the angle, occlusion of the molars, and forward movement of the body of the mandible *B*.

portant finding, however, in this experiment was that the forces produced by the appliance were so strong as to do marked damage of tooth structure and surrounding tissue. Even if we assume that this damage may be repaired by normal reactions of the body, the fact remains that the teeth themselves are affected and moved so much that the importance of the bone changes at other regions becomes negligible. Thus we may draw the conclusion that such treatment would practically not influence the joint and angle since the teeth would move so fast that normal relations of the jaws would be obtained in an extremely short time. This treatment would have very little effect upon the general facial contours. It would, therefore, be contraindicated partly because of the damage produced on the roots and surrounding tissue, and partly because of the negligible cosmetic effect.

The regions involved and the quality of the bone changes found in this experiment were analogous to those found in the first experiment.

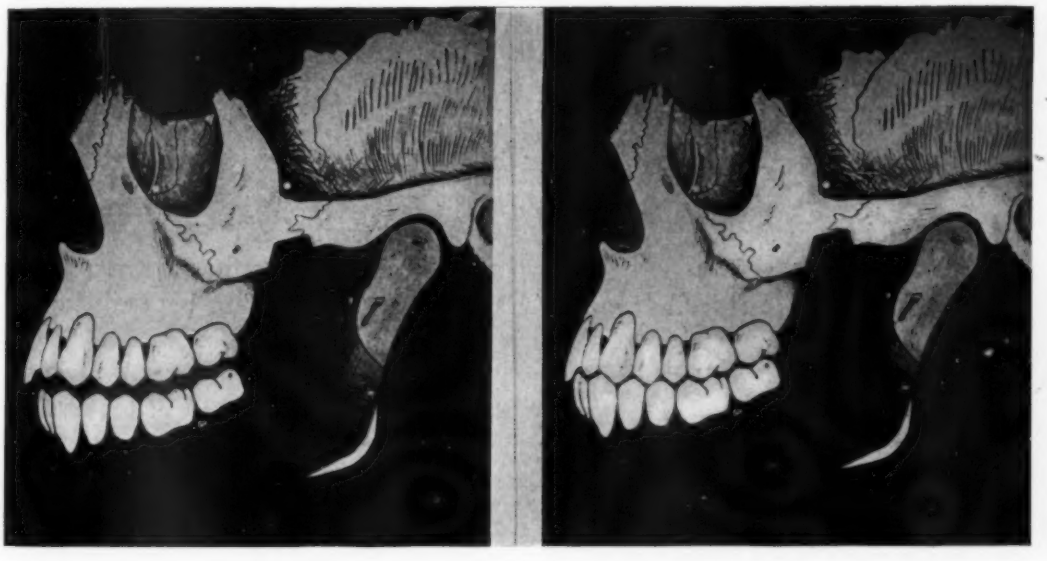


A. *B.*

Fig. 36.—*A*, Anterior bite plane removed. *B*, Suggested splint (diagrammatical, actually much thinner).

Experiment III. (Intermaxillary rubber bands in direction of Class III correction).—This experiment helped to verify the results of the former experiments and substantiated the fact that the bone changes could only be due to the treatment applied. For in this experiment, it must be remembered, forces were applied in an opposite direction and the bone changes occurred reversely. The glenoid fossa is noted to be reorientated in a posterior position permitting the mandible, which is now also altered in form, to assume a more posterior position. The form of the mandible is changed respectively by bone deposition and resorption at the condyle and at the angle thereby indicating shortening of the distance from the condyle to the chin. Naturally this shortening finds its expression in the occlusal relations of the teeth. In addition, the teeth used as anchorage move from their alveoli in a direction to change their position to establish a more distoclusal relation. Since the experiment was instituted in an animal with normal occlusion, an actual distoclusion was effected (Fig. 19).

We can assume that a chin cap used in the treatment of mesiocclusion (Class III) certainly has an effect on the joint and the angle. Since, however, in that type of treatment, the force acts only on these parts of the bulb (and not at all on the alveolar bone) and since we have seen in the other two experiments that the effect on the alveolar bone predominated, we should not be surprised by the fact that this treatment shows results slowly as compared with the other methods used. It is true that with a chin cap it is possible to influence jaw relations without moving the teeth from their alveoli. If not for the time involved this method of treatment may be most desirable to produce proper facial contours. Unfortunately at present we have no such means available for the treatment of Class II malocclusions. In the discussion of the following experiment a suggestion will be made for the possibility of similar treatment in Class II malocclusions.



A. *B.*

Fig. 37.—Result of the bite-raising splint. *A*, With splint in situ. *B*, Splint removed.

Experiment IV. (Raising the bite in the front region by use of bite planes).—The purpose of this experiment was to try to determine what specific changes seen in the former three experiments were due to the bite-raising element of the appliances used. There cemented caps were used raising the bite slightly. The results demonstrated that raising the bite alone increased the mobilization of the joint by a shallowing of the fossa and also demonstrated changes similar to those shown in the first two experiments. Thus, raising of the bite facilitates the correction of Class II cases. This fact has also been proved in practice. It is known that the use of bite plates has a beneficial effect on mandibular distocclusion even if the articulating plane is horizontal and not inclined. Cases have been corrected by this means alone. In fact, raising the bite as an aid to the treatment of Class II malocclusions seems to have been known earlier than has the use of intermaxillary elastics. Samuel Hemley[10] writes, "To recapitulate some orthodontic history, we find that Norman W. Kingsley made the bite plate famous about the year 1880 when he first

utilized this device in the treatment of the malocclusions characterized by distal relationship of the mandibular to the maxillary dental arch. The use of the bite plate for this purpose was popularly known as 'jumping the bite'. . . . . The intermaxillary elastics introduced by Baker offered a new means of treatment, and we find the bite plate thereafter became less and less popular.'' The use of bite planes has recently been advocated by Callaway, Hellman, Oliver, McCoy, and many others.

It is now a commonly accepted procedure to treat some Class II cases by moving the maxillary teeth backward and others by moving the mandibular teeth forward, depending upon whether we are dealing with a maxillary protraction or a mandibular retraction. Moving the teeth forward in cases of mandibular retraction does not, however, produce the most desirable result, even though normal occlusion is attained. Moving the mandibular teeth alone will in no way influence a desirable change in the facial contours. We must all agree that the objective in the treatment of mandibular retraction (Class II malocclusion) should not only result in normal occlusion but—what is even more important—should produce a desirable change in the facial contours. For this reason I venture to suggest that in many cases the most desirable results could be obtained if it were possible to move the body of the mandible forward until normal occlusion is in this way attained without moving the teeth from their alveoli. It has been clearly demonstrated by the results of the experiments that teeth are moved from their alveoli no matter what procedures are employed, as long as a horizontal force is exerted upon the teeth. In our desire to move the body of the mandible forward to its maximum degree it becomes important, therefore, to obviate any forward movement of the teeth themselves from their alveoli. *Whatever anterior movement of the teeth from their alveoli ensues must necessarily reduce the amount of forward movement of the body of the mandible.*

With your indulgence I wish to present a modified use of the bite plane which, I believe, would in some cases accomplish the desired objective. Before doing so I should like to analyze the effect of the bite plane as it is in use at present. In order to properly understand the effect of a given force at any particular region, even if this force may function at various localized regions, it is necessary to assume that only the particular localized area which is to be analyzed can be affected by the force. We may accept this statement as a general rule. Let us assume, e.g., that the labial arch is fixed in the first molars. The incisor teeth are ligated to it and some form of tension applied to protrude them. Some reactions will occur at the roots of the incisor as well as at the roots of the molar teeth. If, however, we want to study the direct effect of this appliance upon the incisor teeth, we should assume the molar teeth as being fixed. Similarly, if we wish to study the direct effect of this appliance on the molar teeth, we should assume the incisor teeth as being fixed. The same principle should be observed in studying the procedure employed in raising the bite where more complicated reciprocal forces function. With this procedure changes occur at several localized areas. Some of these changes are self-evident, and some were shown by the experiment. These changes occur

at the teeth, at the angle of the mandible, and at the temporomandibular joint. The changes at the teeth are self-evident. The occluding teeth are depressed and the nonoccluding teeth have an opportunity to elongate somewhat, due to the loss of antagonists. These changes alone would explain only partly the space resulting between the maxillary and mandibular anterior teeth from the use of such an appliance. The development of the space, however, is speeded by simultaneous changes at the angle, as will be discussed later.

Changes in the joint.—In the joint the following changes occur. Histologic pictures show a transformation of the neck and the condyle. The condyle grows upward and backward while the findings in the glenoid fossa show the position of new bone resulting in shallowing and reorientation of the fossa in an anterior position. To explain these changes it is necessary to review briefly the mechanics of the temporomandibular joint in opening the mouth. Gray,[12] speaking of the temporomandibular joint, says, "It must be borne in mind that there are two distinct joints in this articulation—one between the condyle and the articular disk, and another between the disk and the mandibular fossa. When the mouth is but slightly opened, as during ordinary conversation, the movement is confined to the lower of the two joints. On the other hand, when the mouth is opened more widely, both joints are concerned in the movement; in the lower joint the movement is of a hinge-like character, the condyle moving around a transverse axis on the disk, while in the upper joint the movement is of a gliding character, the disk, together with the condyle, gliding forward onto the articular tubercle, around an axis which passes through the mandibular foramina. These two movements take place simultaneously, the condyle and the disk move forward on the eminence, at the same time the condyle revolves on the disk."

Piersol[13] says, "It was shown that the forward movement of the meniscus occurs even in a very slight opening of the mouth. The angle of the jaw moves forward at the very beginning of the act but soon passes backward." This textbook mentioned the temporomandibular joint as also involved in the mechanics of the joint. "The temporomandibular ligament is a comparatively strong collection of fibers. The fibers run downward and backward from the tubercle on the zygoma to the outer side of the neck. . . . The effect of this insertion is to place the transverse axis of rotation of the jaw not in the head of the mandible, but in the neck."

An exact study of the temporomandibular joint can be found in an article by Frederick P. Lord.[14] He says, "The actual transverse axis about which the jaw turns in opening and closing is through the midpoint of the ramus. The inframandibular muscles could not be responsible for such a motion, and it is very obvious that our data as ascertained from several textbooks are incomplete or incorrect."

Emphasis should be placed on the statement that the transverse axis about which the jaw turns is at the midpoint of the ramus. In explaining this Lord continues, "So far as forward motion of the condyle is concerned in 'natural' opening of the jaw, it is plainly seen that it can be effected only by the two heads of the external pterygoid. The resulting axis of such a motion is located

at a point . . . . at about the region of the midramus or the mandibular foramen.'' He goes on to say in explanation of the action of the external pterygoid muscle, ''When this double muscle acts, it can only pull the condyle, and with it the jaw, forward, effecting a part only of the motion existing in the process of opening the jaw. Here comes the part played by the two structures which are ordinarily left out of consideration entirely, the two special ligaments, the sphenomandibular and the stylomandibular. As the pterygoid heads contract, they immediately make taut these two ligaments, which therefore arrest the forward motion of the midramus region. Further pull by the external pterygoids causes the jaw to tilt, rotating on an axis through the region of insertion of these two ligaments, the region of the mandibular foramen or the midramus, and the chin ascends as the condyle continues to advance.''

Thus Lord considers the external pterygoid muscle functioning primarily to open the mouth.

At any rate it may be assumed that the horizontal axis in opening the mouth is in a region approximately at the midramus.

Sidney E. Riesner[15] has shown by means of x-rays and by moving pictures that in normal opening of the mouth the condyle immediately leaves its center position and moves forward.

In further elucidation of the mechanics of the temporomandibular joint it may be shown, by evidence of the dissected skull, as well as by means of a mechanical model, that, due to the vertical and slightly dorsal direction of the sphenomandibular ligament, the condyle must move forward when the mouth opens. I believe that the position of the sphenomandibular ligament may account for this phenomenon on a purely mechanical basis without having to include also the action of the muscles. Since this ligament limits the distance from the base of the skull to the mandibular foramen, opening of the mouth would of necessity bring the condyle forward. If the condyle were fixed, the ligament would have to be severed in order to open the mouth (Fig. 34).

The mechanical factors are important in understanding changes in the joint due to raising the bite. If it is true that the condyle moves forward even with a slight opening, such as is produced by raising the bite, we should not be surprised to find an adaptation of the bony parts of the joint to this new position of the condyle. This is exactly what we found in the histologic sections. It would account for the changes found at the joint.

Changes at the angle of the mandible.—The histologic examination has shown bone changes producing an increase of the angle. The widening of the angle can be mechanically explained and demonstrated by means of a model (Fig. 35). Let us again assume that all other points of the mandible are fixed and only the angle is changeable. The mandible may be considered as an arch at the tip of which (angle) the chief masticatory muscles are inserted. These muscles, the masseter and the internal pterygoid, act in the same general direction. The temporalis muscle, inserted at the coronoid process, functions similarly. The shape of the mandible and particularly the degree of its angle may be assumed to be the result of a balance between the force of the muscular pull and the strength and architecture of the bone. If we offset that balance by

inserting a bite plane, thus hindering normal relaxation of these muscles, an increased steady pull of the elongated muscles necessarily results in a reconstruction of the bone (John V. Mershon[16]). The angle of the bone widens in order to re-establish the original length of the muscles. This widening of the angle produces also a forward movement of the teeth because of the increased distance from the condyle to the chin. These changes, as presented, contribute to the correction of Class II malocclusion. What has been accomplished is that the mandible has been brought forward without moving the teeth mesially from their alveolar position. This accomplishment has been previously introduced as important in producing the optimal cosmetic result in correcting mandibular retraction.

The changes in the angle explain also why a noticeable space occurs so quickly between the maxillary and mandibular anterior teeth. Three factors cooperate to produce this condition. Two of these are the depression of the occluding mandibular incisor teeth and the elongation of the molar teeth, and the third is the gradual closing of the space between the opposing posterior teeth due to flattening the mandibular arch. All these reasons explain the rapid action of bite planes in correcting the curve of Spee, but they explain also why the bite plane placed in the anterior region does not result in the complete correction of Class II anomalies. I am now ready to present the modification in the procedure of bite plane therapy which I believe may effect the complete correction of Class II malocclusions. Fig. 36*A* presents diagrammatically the amount of change and correction obtained by means of the accustomed anterior bite plane. We note the slight forward movement of the mandible, a space between the maxillary and mandibular anterior teeth and occlusion in the molar region. The muscles have regained their normal length and a new balance has been established with the bite plane in position. The curve of Spee, usually exaggerated in Class II cases, has been reduced to normal degree. There is no mechanical reason for any further change to occur unless we again disturb the balance obtained. In the past this has been attempted by increasing the thickness of the bite plate, thereby opening the bite again, or by removing the bite plate entirely. In the latter instance, all one can expect is partial retrogression unless, and this is very rare, the occlusal surfaces, cusps, and grooves of the mandibular posterior teeth have already reached a relation to their antagonists where further development toward normal occlusion may result from the interdigitation. Even if this were true, retrogressive forces may still act to hinder further improvement. Instead, an additional means of stimulation for additional transformation of the mandible may be employed. Following the use of the anterior bite plane, I now recommend the use of a kind of splint (Fig. 36*B*) which is to cover the incisal edges of all the anterior mandibular teeth and occlusal surfaces of all the posterior mandibular teeth. This splint is to be so designed as to act as a bite plane for the posterior teeth, leaving a space between the anterior teeth. This would serve to retain the corrected curve of Spee, to produce strain again on the same masticatory muscles with the resultant action producing change of the mandibular angle. It would serve in addition to depress both the maxillary and mandibular molar teeth, and, lastly, to produce additional changes in the joint.

In depressing the molar teeth the distance from the occlusal plane to the lower border of the mandible is shortened and simultaneously the body of the mandible, including the chin, is moved forward (Figs. 36 and 37). The amount of forward movement of the mandible is far greater than the diminishing of the mandibular height. The changes occurring simultaneously in the joint also counteract the effect of the diminished height of the mandible. This is explained in the following manner: Having assumed that the molar teeth are depressed, decrease in the height of the mandibular body would necessarily result. If instead we regard the molar teeth to be fixed, we may better understand the changes occurring in the joint. These partly counteract the effect of the lowering of the mandibular height without interfering with the desirable horizontal action. Those changes in the joint which result in a more anterior and lowered position as well as a posterior and upward inclination of the condyle have already been described. They result in an increased distance from the base of the skull to the lower border of the mandible. In this way the length of the ramus is increased, counteracting the diminished height of the mandibular body.

This procedure may eliminate or reduce the necessity of intermaxillary rubber bands and thus eliminate any horizontal movement of the mandibular teeth which would leave the position of the chin unaltered.

I would advocate the construction of bite planes without cusp eminences so that free gliding movement would be unhampered. Such bite planes have been found most effective in practice. Personally I would prefer a horizontal bite plane instead of an inclined plane. The use of the inclined plane very likely tends to produce in part a movement of the teeth themselves from their alveolar positions in an anterior direction similar to the condition obtained in "jumping the bite." Excessive strain on the supporting tissues of the articulating teeth is an additional disadvantage of the inclined plane.

The discussion of the use of this modified bite plane and the analysis of its possible results have so far been only on a theoretical basis. It will be necessary to test these hypothetical conclusions by experimental methods. This I hope to do soon. At any rate I do not believe that the empiric application of this procedure would produce any deleterious results, and I would recommend its use in selected cases.

SUMMARY

While various experiments had been performed in the past to determine the nature of tissue changes as the result of applied forces, we still felt that the whole question regarding the extent of tissue involvement and its behavior to the forces used in orthodontic treatment was very much in an empiric state. A series of experiments was instituted, therefore, in which typical methods of orthodontic treatment were employed, the changes noted clinically, and the animals subsequently sacrificed for a careful histologic study. The animal used was the *Macacus rhesus*. Two standard methods of treatment for Class II malocclusions were used; one, intermaxillary pressure by means of rubber bands and the other, jumping the bite. In histologic study the alveolar bone surrounding the posterior teeth, the angle of the jaw, and the temporomandibular joint were all studied. Changes were found in all of these regions to

indicate, through the evidence of apposition and resorption, that the forces applied resulted not only in a mesial movement of the posterior teeth but also to indicate a reorientation of the position of the body of the mandible by a change in the angle of the jaw and changes in the form and position of the condyle head and glenoid fossa. To determine whether these changes were due entirely to the forces applied, an additional experiment for verification was performed in which the forces applied were as if for treatment of Class III malocclusion. These forces were, therefore, in an opposite direction and the findings showed changes directly opposite in direction to those applied in treatment of Class II malocclusion.

Because of the changes observed at the angle of the jaw and the temporomandibular joint, a method is suggested to correct cases of Class II malocclusion by means of forward movement of the body of the mandible without movement of the teeth in the mesial direction from their alveoli.

CONCLUSION

The findings in these experiments in correlation to clinical observation justify a prognostication of specific tissue changes in the region of the angle of the jaw and the temporomandibular joint as the result of specific mechanical forces applied.

I wish to extend my appreciation to Dr. Leuman M. Waugh and Dr. Moses Diamond of Columbia University School of Dental and Oral Surgery for their generous assistance. I should also like to thank Dr. George S. Callaway for photographing the illustrations Figs. 33 to 37.

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DISCUSSION

Dr. Sidney E. Riesner.—I should like to employ this occasion by helping to emphasize the fact that we have witnessed a unique and most illuminating presentation this morning. We have seen a demonstration today of some of the facts known to some of us but not proved, which I welcome most heartily and with grateful thanks. Dr. Breitner's histologic demonstration corroborates some of the effects which I have recorded roentgenographically

in the last few years, but which have been puzzling to me. I knew they were there; I saw them on x-ray pictures by comparison, but had not quite an adequate explanation for them. It might be a comforting thought to Dr. Breitner that I have recorded these changes roentgenographically in the joint, in the angle of the jaw, and the head of the condyle. At the last meeting at the symposium given by Drs. Callaway, Blumenthal, and Hopkins, I mentioned a case during the discussion that was treated empirically with a bite plate. I expected to see a change that would bring the condyle head anterior to its normal position, whereas in truth the positions recorded showed there was a very definite demonstration of the condyle head in its normal position, although there was a change in the angulation of the neck and also of the gonial angle. This morning's demonstration very uniquely shows the *raison d'être* or the possible procedure that followed histologically. I think we should take cognizance of the fact that bone, being fluid, will unquestionably react to the gentle forces applied to it, and will be stimulated in the direction of the force applied; that ahead of it there will be deposition and behind there will be the resorptive processes accommodating the change. Again, I want to extend my appreciative thanks to Dr. Breitner for demonstrating and explaining some of the facts that have been puzzling me.

TIME TO BEGIN ORTHODONTIC TREATMENT

MAURICE MOSKOWITZ, WILKES-BARRE, PA.

CLINICAL experience in orthodontics has shown beyond possible question the advisability of treating malocclusion as soon as it is evident. This statement precisely suggests the idea that corrective measures should be resorted to as soon as it is apparent that abnormal development of the dental arches is taking place. Because each case of malocclusion is decidedly individual, it is quite apparent *that no definite time* can be established for the institution of treatment. It has been noted that each case has striking similarities, and parallel in such degree to other cases, that they can be safely classified and treated.

In this consideration a careful study should be made of the history of the case, particularly in regard to deviations in bone growth. If normal bone development is being interfered with, it is quite probable that normal bone changes and physiologic development will not take place in the jaws. Consequently the final success of the treatment in regard to tooth positioning and arch relationship will not be as complete as desired.

A full mouth x-ray study may indicate missing or supernumerary teeth or other abnormal growths. The length of the roots of the deciduous teeth and the degree of development of the permanent teeth should be observed. These factors are important in a decision as to the correct time to apply treatment. The number of deciduous and permanent teeth present, the positions of the teeth in each arch, and the relationship of the arches must, of course, be given close attention. Pernicious habits as well as other remote causative factors must also be given consideration.

In making this survey, the purely technical knowledge of the orthodontist must be supplemented and governed by a well-balanced judgment in differentiating between the many etiologic factors of malocclusion, occurring at an early age. The problem is one that involves vital processes of functional activities affecting phenomena of dentition, as well as those remoter effects of biology, physiology, and endocrinology that must be taken into account for the making of a complete diagnosis.

The development of the dental arches is subject to the same biologic laws and principles as the development of any other part or organ of the body. It is of primary importance that the orthodontist in collaboration with the pediatrician consider the child as a whole, living, functioning organism. Special attention should be directed to his physical and physiologic setup, his psychologic balance and personality make-up and functioning, before deciding on treatment. The teeth and jaws are after all only one part of the whole child and should not be considered except in relation to the growth and functioning of the child.

Read before the North Atlantic Orthodontic Society, Nov. 15, 1939.

All illustrations are taken as published from the collection of Dr. Edward M. Griffin, New York City.

When the teeth are in malocclusion, the supporting tissues do not receive normal stimulation, due to the normal stress of mastication, which is considered so important in the development of the alveolar process. The pressure exerted by the normal movements of the mandible is accepted as largely responsible for the development, at least, of the lower half of the face. That being the case we must view the subject as of a biologic nature and approach it from that standpoint. Normal growth is largely dependent on normal form and normal function. Form and function are so definitely correlated that any abnormal condition of one will be manifested in the other.

We should assist nature during her early developing period at a time when the balance between normal and abnormal is nearly equal, and the influences of an abnormal nature are fast making themselves apparent. Many cases are started too late; many too early for best results. From the standpoint of the orthodontist the diagnosis of malocclusion of the teeth of the child means the recognition of tooth relations that are probable hindrances to normal developmental processes. The difficulty in the question of early treatment is not one of *treatment* but one of *diagnosis*. Whenever we recognize a condition which interferes with normal development, it should be corrected. There is no question of *time of treatment* when such conditions are known to exist. The problem is to recognize the presence of such conditions.

Fig. 1.

Fig. 2.

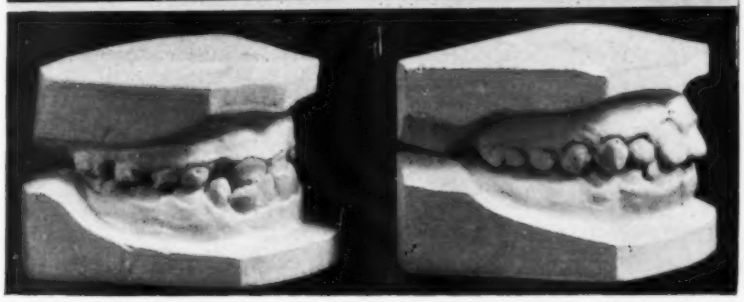

Fig. 1.—Illustration of normal occlusion and malocclusion of right and left lateral segments of the same case, showing the effects of irregularity of the exchange of the dentitions with lack of operative procedures for the prevention of such a condition on the side of malocclusion.

Fig. 2.—Illustration of functional Class III due to deficient development of premaxillary area, which indicates need of treatment to remove interference with normal development.

Early treatment does not necessarily mean treatment by appliances but implies that preventive measures should be given thorough consideration. The suggestion of an extraction at the right time is just as important as moving the tooth with an appliance. Myofunctional therapy, grinding of deciduous teeth, space maintainers, the breaking of habits will all tend to intercept mal-

occlusion. This does not preclude, however, orthodontic interference when a malocclusion is evident. During the early developing period of the child, growth and repair are most rapid, and the surrounding tissues most yielding. At this juncture slight force is sufficient to gently direct each erupting tooth into its correct relation with the line of occlusion. Unless some remote physical condition exists it is a serious mistake, without argument, to defer the procedure until all the teeth shall have erupted. To such a gross oversight are directly traceable myriads of cases of pronounced malocclusion, with the accompanying distorted facial lines, impaired speech, etc. By prolonging this early manifestation, the whole dental apparatus will become involved, the teeth firmly fixed in their malpositions, facial lines marred, the lips and muscles modified to function in harmony with the complicated malocclusion—all of which could have been prevented had early treatment been instituted. The absurdity of delaying treatment hoping that nature will correct the deformity is not alone groundless but foolhardy.

Of the many widely advanced theories as probable causes of malocclusion, the genetic seems strongly supported. Believers in this theory hold to the fact that since the genes are the constituents of the chromosomes, they determine the possibility of development through inheritance. They maintain that neither heredity nor environment alone determines any characteristic disturbance, but as a result of the interaction of both, allowing of course for the action of the homones, the malformation will be made evident.

The endocrine make-up leaves little doubt as to its importance in its influence on dental development and skeletal growth. Reviewing the literature of Erdman, Downes, Howard, Engelbach, Todd, and others, we are impressed with the fact that endocrinology is bringing to light many unknown etiologic factors. These operate even through the maternal placental (fetal) circulation, through infancy and childhood as a cause of abnormal development of the jaws and the teeth, that gives rise to all degrees of malocclusion. This means that following correction of abnormal teeth relations by means of appliances, or before or during treatment, depending on the individual case or indication, every effort should be made to insure normal functional relations of the surrounding parts. This implies close cooperation between the pediatrician and orthodontist. The correction of the constitutional defects will make the percentage of failures less and the prognosis better. Malnutrition deprives the growth impulse of the teeth and bony structures as well as other tissues of the body of its sustenance and has been shown to be the fundamental cause of some endocrine disturbance.

The need for early recognition of endocrine imbalance and its treatment is imperative in conjunction with orthodontic procedure. Frequently cases never get to the family physician. In many instances the physician fails to call the condition to the attention of the parent. Therefore, we as orthodontists should be able to detect the presence of glandular pathologic conditions. This done, we will be in a position intelligently to make ourselves familiar with the clinical manifestations of glandular imbalance. In this connection a list of signs suggestive of the condition should prove valuable. The physical symptoms reflected in the personality of the patient should be noted, whether he is *overactive, hyperirritable, underactive, apathetic,* or *mentally retarded:*

Weight.—Marked overweight or underweight for his age.

Height.—Marked overheight or underheight for his age.

Configuration.—Bony disproportion and abnormal fat distribution.

Skin.—Any marked deviation from normal, particular attention being paid to pigmentation, texture, hydration, tonicity.

Hair.—Any abnormal distribution.

Eyes.—Protruding, slanting, or irritated lids.

Nose.—Underdeveloped, sinusitis.

Mouth.—Delayed dentition, rapid caries, abnormal spacing, prognathism and abnormalities not otherwise accounted for.

Neck.—Enlarged thyroid.

Extremities.—1. abnormally large or small hands.
2. abnormally long or short fingers.
3. tremors of the fingers.

The selection of an opportune time for orthodontic interference, as well as the decision on the rest periods during the treatment, is highly important. Since periods of growth do exist, one can establish upon the individual child over a period of time, a definite value of hand bone progress as an index to jaw bone progress.

A routine examination of the wrist, as shown by Todd, is essential at the outset of treatment when full roentgenograms are taken. These pictures show the true physiologic age of the patient as compared with the chronologic age. While bone development in other parts of the body is of great value in determining physiologic age, the bones of the wrist are particularly suitable for such determination as they are first laid down in cartilage, and later transformed into bone by the laying down of mineral salts. The various ossification centers are filled out in predetermined order. (Todd and Shelton have a chart showing wrist development.) Having determined normal development of the wrist for the corresponding age of the patient, we can now more readily tell whether or not the patient is advanced or retarded in bone growth.

We are at the stage where clinical experience regarding physical maturity attained by the child is being translated in concrete terms of developmental growth. Hellman and Broadbent have spent much effort in opening up the field dealing with this subject. It may be expected that before long we shall have a schedule which will define the stage of dentofacial development at which particular orthodontic procedures are most likely to meet with permanent success.

The question of age for orthodontic treatment is shown then to be inseparably linked with diagnosis and it seems unreasonable to set a chronologic time for it. One should attempt to produce conditions of occlusion and function and stimulate development that will be normal for the patient at his specific developmental age.

On the subject of early irregularities I should like to quote you both Drs. Lischer and Young.

Lischer says:

> It is well to remember that a favorable prognosis depends largely upon an early diagnosis when conditions are such that a comparatively simple treatment will suffice.

Formerly it was the custom to postpone most treatment until all of the permanent teeth had erupted, for it was believed that Nature would assist in the correction of the malocclusion and that most patients would "outgrow" the deformity. Many bitter disappointments have taught us the error of such advice, and strongly emphasize the fact that severe forms of malocclusion do not develop overnight, but are of slow growth. Hence it follows that years before even an intelligent parent recognizes the impending deformity, the alert diagnostician can advise ways and means for its prevention. Owing to the mechanical aspects of dentition, the self-correction of most forms of malocclusion is an impossibility. Every fact gleaned from a study of the process of dentition substantiated the orthodontic axiom that malocclusion and its accompanying deformities are progressive not static. The restoration of normal function during the developmental period is a fundamental principle of rational treatment. The period of tooth eruption is the period of greatest growth in the alveolar process.

J. L. Young says:

When the deciduous teeth are found to be in malocclusion to a marked degree, it is of utmost importance that correction should be instituted, as early as conditions will permit. The longer that such cases are allowed to go untreated, the greater the difficulties encountered, and the less certain the final result. Believing that normal function is of utmost importance in the development of the dental arches and masticating apparatus, then what can be more logical than we establish such relations as early in life as possible, so as to permit the teeth of the deciduous set to occlude properly. If you will concede that the histologists have proved that bone is developed in accordance with mechanical stimuli, then it is most logical that you concede that when the deciduous teeth are in such relation that normal function is interfered with, normal development is impossible.

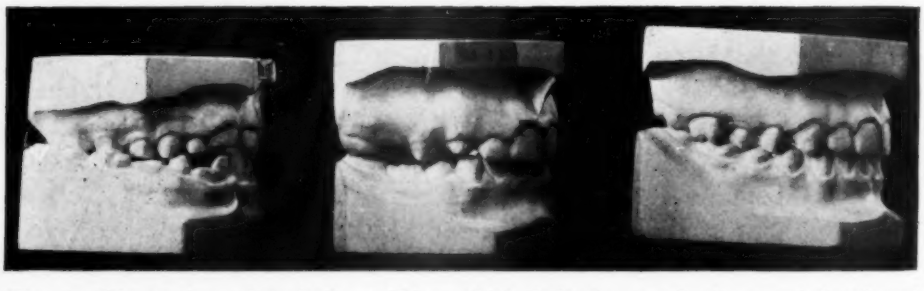

Fig. 3.—Illustration of typical condition which indicates need of prompt treatment because of deficient lateral development, inhibiting proper eruption and alignment of permanent incisors and causing instability of arch relationship as presented by malocclusion of one lateral segment.

The deciduous dental arches should be corrected orthodontically in cases:

1. Where there is abnormal arch form in a prominent degree.
2. Where there is abnormal anteroposterior relationship.
3. Cases of cross-bite.
4. Open-bite cases.

In these cases slight treatment with delicate appliances will produce favorable results. To gain greatest benefit in such cases, treatment should be started when the roots of the deciduous teeth are fully developed and no absorption has occurred. At this point there is very little development of the permanent teeth.

Radiographs should be taken during the period of absorption of the deciduous roots, and the coincident development of their permanent successors, before attempting treatment. Orthodontic treatment instituted where there is

absorption of the deciduous roots and advanced development of the permanent teeth will have little or no effect on correcting the latter.

During this period, however, corrective treatment can be applied to the deciduous molars, and first permanent molars if erupted. This is an ideal time to widen the arches and correct anteroposterior relationship.

During the mixed dentition period—at the time of eruption of the permanent incisors—it is favorable here to treat mandibular incisors in torsiversion, or for widening the arch.

If the maxillary central or lateral incisors erupt in torsiversion, treatment should be started at once.

Maxillary incisors erupting lingually to the mandibular teeth, or mandibular incisors erupting labially to the maxillary teeth, should be corrected promptly

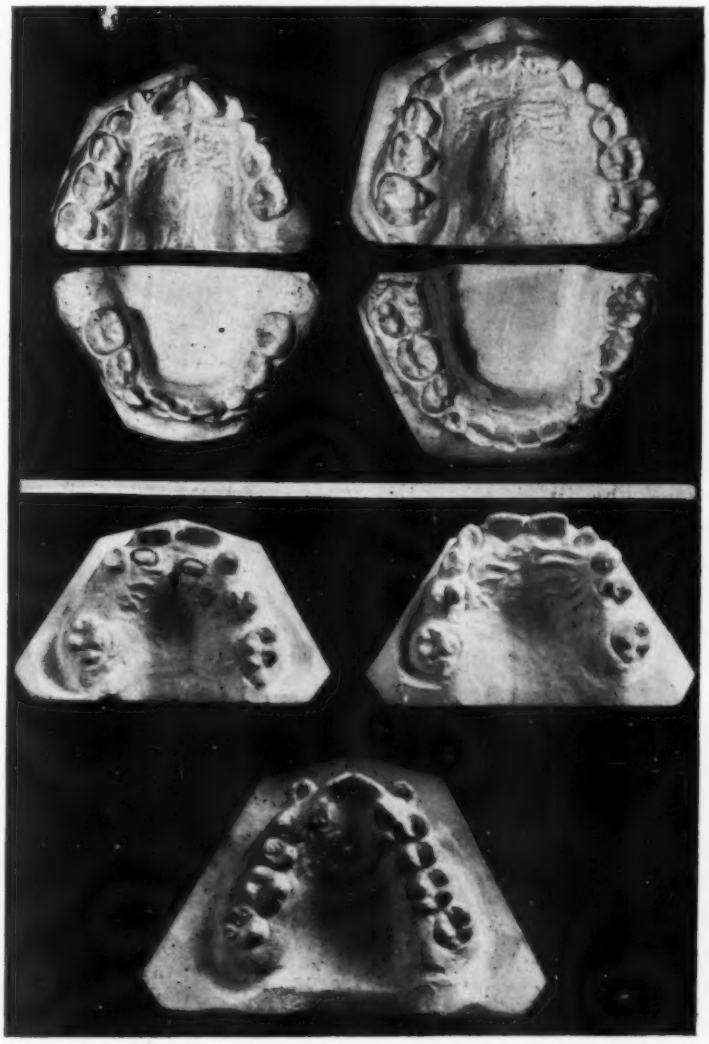

Fig. 4.

Fig. 5.

Fig. 4.—Illustration of decided deficiency of premaxillary development which indicates need of treatment to produce the result shown in providing for satisfactory development with suitable alignment of incisors.

Fig. 5.—Illustration of desirability of properly treating case with decided premaxillary deficiency even at time deciduous exfoliation is almost completed, with result. In contrast is shown similar condition at later age with increased osseous resistance and reactions if treated, with prognosis for satisfactory development less favorable.

to avoid a more serious malocclusion. Immediate treatment should be begun in cases where the premolars are erupting in malocclusion.

If found necessary, space should be provided for in the arches for the eruption of the permanent canines.

Second molars occasionally erupt in malocclusion and should receive treatment as soon as they have erupted sufficiently.

The period of eruption of the permanent first molars and incisors is without a question the most valuable time for orthodontic treatment in the majority of cases; for if the permanent first molars and incisors are placed in their normal positions at this time, many cases will require no further treatment.

True mesial cases should be started as early as possible.

Cusp-interlocking should be treated when observed, and the traumatic occlusion promptly removed.

In mutilated cases, where there is loss of teeth or a decided deflection of the arches, elongations, extreme spacings, and irritations, treatment should be instituted.

Class I cases, with Class II propensities, should be promptly cared for. Here we should also resort to myofunctional therapy.

Class II and Class III cases should be treated early, because these conditions are progressive with no chance of becoming normal. Since these cases involve arch abnormality rather than mere tooth malposition, they can be treated as well or better by using the deciduous teeth. There is a difference in opinion, as to the possibility of retaining a treated deciduous distoclusion. The consensus favors that these cases be selected. Immediate attention is given only to those associated with mouth breathers, abnormal musculature, and cases of deficient mandible.

After reviewing the literature, including the findings of Young, Baker, Lischer, Strang, Willett, Chapman, and others, on favorable time for orthodontic procedure, one is impressed with the general agreement—that early treatment of malocclusion may be successfully undertaken with favorable prognosis. It is generally conceded that the type of malocclusion found in the permanent dentition may occur in the deciduous dentition, and the treatment in either instance is based on the same fundamentals.

Our real need is a wider knowledge of the etiologic factors, local or general, as they affect growth of the jaws and associated structures. Such information would enable us to make a more scientific, differential diagnosis of the cases we are about to treat.

Important factors, then, to keep in mind when considering the "best time for orthodontic treatment" are:

1. One should aim to establish the most efficient masticating mechanism for the individual, by maintaining character and form of bone growth.

2. The period of wearing orthodontic appliances or retainers should be as short as consistent with the maximum physiologic development.

3. The teeth should have as much natural freedom of movement during development of the dental arches as possible.

4. One must differentiate between normal and abnormal during the deciduous, mixed dentition, or transitional and permanent tooth stages.

5. One must recognize a variation of normality in different individuals.

6. A broader concept of treatment includes etiology and all efforts should be directed toward establishing normal functioning occlusion.

7. Physiologic age is more important than chronologic age in the treatment of malocclusion. Therefore, it is impractical to designate a specific age for treatment, that will meet the requirements of all cases.

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RESPONSE TO THE PAPER BY DR. MOSKOWITZ, "TIME TO BEGIN ORTHODONTIC TREATMENT"

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THE essayist is to be congratulated upon his excellent condensation of the vast sweep of subject material which he has inculcated in this presentation. The subject is of great importance; it involves considerations from many points of view, as well as being pertinent to many phases of the biologic as well as of the mechanical problems in orthodontics. It really requires a symposium of speakers on the subject to treat it with even a fair degree of completeness.

The subject is so important and appropriate to a program of this society because of the role of the general practitioner, who generally holds within his hands the responsibility of directing, or advising, a course of action toward treatment or avoidance of treatment; that of assuming responsibilities for the dental health welfare of patients ranging in ages from completion of the deciduous dentition to young adult life.

First, I wish to review briefly the cardinal points as stressed by Dr. Moskowitz, with brief comment, and with which I am in decided agreement. Later in this discussion, I wish to give some explanations, from somewhat different points of view, to cite reservations and offer alterations to the interpretations as would be gleaned from the discourse of the essayist.

The statement that there is no definite time for treatment, since the requirement of each case is individualistic, is well founded. The statements pertaining to the advisability of careful study of case history, x-ray checkup, the involvement of considerations of all phenomena concerning the vital processes in effecting a complete diagnosis, are well stated. We must give due consideration to the biologic-mechanical concept of orthodontics today, which in a larger sense, does include all the phenomena concerned with the processes of life itself.

The subject now brings us to face two cardinal biologic considerations which have definitely set up two schools of thought as they have produced groups who give particular credence to the factors on one side as against those on the other. These are that normal growth is largely dependent on normal form and function and that normal form and function are interdependent. Form and function are so definitely correlated that any abnormal condition of one will be manifested in the other. As against this principle, we must pit that which concerns the forces of heredity; that is, malocclusions are reflected through heredity, prenatal in origin, and disharmonies seem to arise in the intermixing of racial characteristics. We do not have evidence of inheritance of a distinct malocclusion as such, but we do have that of definite patterns in facial morphology and that inherent tendencies of facial growth are not altered by changes in the occlusion of the teeth, as has been recently stressed by Hellman. As stated by Bordeen, "The form of the skeleton as a whole and of the individual bones depends partly upon heredity and partly upon the mechanical influences to which it is subjected during growth."

Read before the North Atlantic Orthodontic Society, Nov. 15, 1939, New York City.

The considerations pertinent to the importance of endocrine balance, to the desirability of cooperation between the endocrinologist, pediatrician, and orthodontist are highly commendable. I know that the association enjoyed by Dr. Moskowitz with Dr. Kugelmass, who gave us such a valuable discourse at our last North Atlantic meeting, by including the role of endocrines, came duly to the mind of the essayist in including these considerations in his essay. The references, also, to recent contributions by Todd are properly stressed in recognition of additional angles of approach to orthodontic diagnosis through skeletal radiography, the better understanding of disturbing factors during periods of illness, conditions of malnutrition, or endocrine syndromes, each presenting manifestations of profound disturbances in growth processes. These are shown by alterations in registrations of accelerated and retarded periods and all emphasize again the trend toward constantly enlarging the diagnostic field of orthodontics. The essayist has thus explained this broad background which is essential to an understanding of more specific discourse in treating the subject of time for orthodontic treatment. The first cardinal point we now see to be that the physiologic age must be the basis of giving expression to the time factor, not an expression of chronologic age except as that is used in comparative explanation. That many cases are started too early and many too late, I agree and herewith would like to interpolate that, in my opinion, the *application* of good orthodontic judgment is perhaps no more strikingly shown than by the attention which the operator gives to treating in stages, only when in the light of all evidence available, which may guide his decision, he so stages such treatment. It is my experience that stimulation, particularly through mechanical therapy of appliance assemblage, should be given at the wake of a period of acceleration which has been given ample time to show conclusively that it manifests a decided retardation or a status of feebleness of growth activity. The operator's role is to step in and so stimulate as to speed up a delayed or feeble natural rate to bring about a status which would be construed as within the range of the norm for the respective physiologic stage of development with a well-balanced condition toward maturity as pertaining to the complete masticatory apparatus. As has been pointed out, all orthodontic therapy does not imply the use of appliances (still about 90 per cent does), and as a concrete illustration if we are confronted with a habit problem, our decisions concerning the time and the method of procedure will be based upon quite different considerations than whether treatment should be instigated for a given status of jaw growth or formation.

With reference to the statement of Dr. Lischer, I wish to express my disapproval of the arbitrary stand which is taken by many as tersely stated in the slogan, "Wait until all the permanent teeth are erupted." The pendulum of thought has swung from two extremes, and today it seems assured that best reasoning is directing us toward a middle ground as between advisability of extensive treatment at early ages as against doing nothing until the permanent dentition is completed. However, in this reaction, which strongly manifests itself now in orthodontic study activities, to swing back again toward the trend for early treatment as against the "100 per cent permanent toothers," I do find

that certain claims, advice, and deductions are advanced which do not bear out in clinical experience; neither do I find clear evidence of their scientific basis. Again we are faced with what I have repeatedly stressed in orthodontic writings, that this art and science is in a status of flux, it is replete with contradictions in consideration of the very fundamental principles upon which it rests; the groups, though commanding respect as authorities, are diametrically opposed to one another in expressing their interpretations of the vital phenomena involved.

And so, at this point, as discusser, I offer some of the controversial points of view as pertinent to our subject at hand. Dr. Lischer says, "It is well to remember that a favorable prognosis depends largely upon an early diagnosis when conditions are such that a comparatively simple treatment will suffice. Formerly it was the custom to postpone most treatment until all the permanent teeth had erupted . . . many bitter disappointments have taught us the error of such advice . . . malocclusions are of slow growth . . . hence it follows that years before recognition by the parent, the alert diagnostician can advise ways and means for its *prevention.*" Again says J. Lowe Young, "Believing that normal function is of utmost importance in the development of the dental arches, then what can be more logical than that we establish such relations as early in life as possible, so as to permit the teeth of the deciduous set to occlude properly; when the deciduous teeth are in such relation that normal function is interfered with, normal development is impossible." Again, as stated by the essayist, as his very opening topic sentence, "Clinical experience in orthodontics has shown beyond possible question the advisibility of treating malocclusion . . . as soon as it is apparent that abnormal development of the dental arches is taking place." Now we are instantly plunged into a maze of confusion. You may judge that the discusser *and* the discussed are confused and well may that be true in dealing with so complex a subject as growth and development. Yet, a subject which calls for no discussion in the light of difference in interpretations with probable difference of opinions would be of much less value on an orthodontic program. In the above quotations, we have what seems to be reasonable deductions expressed in very smooth phraseology, but, I ask, what is the basis of determination concerning whether an abnormal or normal condition exists for a particular stage or period of growth? Do the authors mean to say that a distoclusion cuspal relationship of the deciduous dentition manifests an abnormal condition wherein jaw growth is thwarted and all associated muscular activity is suppressed? Do they mean to say that such an occlusion can and should be corrected at the earliest notice? Do they mean to infer that when we commonly see beautiful deciduous dentitions in excellent occlusion, suddenly transform to conditions of developing gross irregularities as regard occlusion and disharmonious jaw patterns, existent in the transitional stage, that we here have this profound change manifesting itself *because* suddenly there has been a *change* or *curtailment* of functional activity? I say such expressions as quoted are very generalized and misleading. If I may resort to personal citation, I am one of those orthodontists who wanted so very much to believe that malocclusions should be corrected as soon as evident, that the alert diagnostician could prevent severe malocclusions by intercepting them while they were in a status of

incipiency, through comparatively simple treatment, that we were able to distinguish readily between the norm and the abnormal at any given stage of development and that treatment would readily bring about a status which would definitely and permanently remain within the range of the norm. But I must state, that after twenty years in the practice of orthodontics exclusively, in consideration of orthodontically treating what we may term to be the boy or girl of average saisfactory health, that is, with no *distinct* endocrine, malnutritional, or abnormal growth processes (except to state that definitely severe degrees of typal malocclusions did exist), my experience has been that my keenest disappointment has been my efforts to *prevent* malocclusion, prior to the permanent dentition stage WHEREIN MAL-JAW RELATIONSHIP WAS INVOLVED. I do not wish to be misunderstood as classifying myself among the "100 per cent permanent toothers," but I do wish to stress the necessity for classifying what conditions, in the light of my experience, may satisfactorily respond at a given stage and which ones will not. In Dr. Frank A. Delabarre's presentation on "Indications for Early Treatment" he concisely states twelve attributes for the human dentition which are common to any norm and these are correlated with the successive steps of growth and development of occlusion from early childhood to adolescence. But, in a reply so well expressed by Dr. A. Wolfson, we note, "It is perfectly true that there is some sort of time sequence, direction, amount of growth, and zone for all this process of growth, but, if we look at these dynamically, we must become aware of the fact that Nature does not have a mathematical plan for the exact eruption and position of all the teeth, but rather it has a generalized, unrelated, and a very complicated plan; sometimes it works according to Hoyle and sometimes it does not. Those of us who have looked at these problems in those terms have found inevitably that there develops a tendency in our practices to treat cases not earlier and earlier, but later and later." Again in giving consideration to growth processes from a dynamic point of view, let us note from the conclusions of Stanton and Goldstein, the inexplicable data as revealed from observations of hundreds of cases over a period of many years. "It is not altogether clear why Class II type of malocclusions should first show improvement in the deciduous dentition and later in the transition period and in the permanent dentition should manifest a relatively sharp rise in incidence. . . . Of special interest are the fluctuations in types of malocclusion during the deciduous, transitional, and permanent periods. . . . The frequency of Class I drops sharply in the permanent dentitions as compared with conditions in the deciduous stages or with those present in the transitional stage, or at the same time Class II or even Class III increases markedly in prevalence during the full permanent dentition period." We have definite evidence that the growth factors as manifested at certain stages may produce fluctuations in the status of the occlusion while the inherent pattern is slowly revealing its configuration. Thus we are in dire need of certain reservations, if we give a proper degree of credence to statements which imply completeness and precision in axiomatic terms with reference to so complex and, still, little understood, subject as growth and development. In considering the advisability of correcting malocclusions as soon as evident, let us draw these reservations:

1. What degree of malocclusion would you immediately treat?

2. Can you be certain that malocclusions present permanency or as a transitional phenomenon in harmony with many other transitions which are taking place as growth processes?

3. It is generally conceded that we are gaining in the power of discernment to recognize malocclusions at much earlier periods than we could formerly. Is it advisable likewise to treat earlier and earlier to conform with these observations?

4. What is the nature of our therapy and what is the condition of the dentition which assures us that the condition may be responsive to the therapy, wherein we may attain a successful result? Is it possible to treat, successfully, malocclusions at their earliest appearance? Regarding this point, my observations are in accordance with those of Dr. Thornton W. Taylor who made a world tour to study orthodontic conditions. He concluded that from the numbers of patients, 12 years of age or over, who were being treated orthodontically in comparison with those numbers of children who were under the orthodontists' care at earlier ages, the evidences of any completeness or of *prevention* being accomplished to avoid work at this later period, were woefully lacking.

Further questions for consideration in analyzing this subject also concern very specifically the relationship of occlusion to growth and the role of the temporomandibular joint to the establishment of occlusion. Upon our answer to these relationships should be based our decisions regarding the proper time for treatment of anteroposterior occlusal disturbances. Here again we find profound confusion and disagreement. Hellman says, "The rough idea conveyed by the occlusion of the teeth is no criterion at all to distinguish development so far as the rest of the individual is concerned. It is not occlusion that determines development; it is the other way around. Occlusion may be the last vestige, holding the dentition on the normal side, when the surrounding parts have already crossed the boundary line. We are impressed with the rule of variation, not of uniformity." Lundstrom says, "Occlusal conditions are unable, mechanically or by means of function, to alter the size or form of the apical base. The apical base controls occlusion and not occlusion the apical base." But Dr. Delabarre said, "I maintain that it is the length of the cusp that determines the overbite because the length of the cusp determines the path that the condyle takes in function. The height and angle of the eminentia are determined by the path that the condyle must take as influenced by the length of the cusp, so the length of the cusp is the determining factor. The eminentia is formed only by the repeated excursions of the mandible in whatever path it takes, and if there is a change in that for any reason, we shall see a change in the eminentia; so it is not the eminentia that determines the path of the excursion." This statement is clearly allied with the claims of Alfred Paul Rogers, who is the outstanding exponent, today, of myofunctional treatment and who claims that there is a complete structural reorganization produced by definite osseous reorientation, as particularly affecting the eminentia in the treatment of distoclusal cases.* Briefly, this treatment is described by Rogers,

*The Behavior of the Temporomandibular Joint in Response to the Myofunctional Treatment of Distoclusion, INT. J. ORTHODONTIA, P. 426. 1935. Place of Myofunctional Treatment in Correction of Malocclusion, J. A. D. A., P. 66, 1936.

as follows: "During the performance of the pterygoid exercise the head of the condyle is shown well down upon the eminentia following the application of the inclined plane apparatus; the head of the condyle remains temporarily fixed in this position . . . the head of the condyle while it is temporarily fixed in its advanced position, gradually is seen to return to its former position in the glenoid fossa. It is our custom with all distoclusal cases to take two radiographic pictures of the articulation before treatment, one showing the condyle in its habitual position with the mandible in distal position, the other with the arches held in correct mesiodistal relation with the condyle drawn well down on the eminentia. Following these, pictures are taken during progress of treatment. These subsequent pictures show the gradual recession of the head of the condyle back to its normal position in the glenoid fossa. During this period the arches are continually held in their correct mesiodistal relation by the use of the inclined plane and the masseter-temporal exercise is being continued daily.

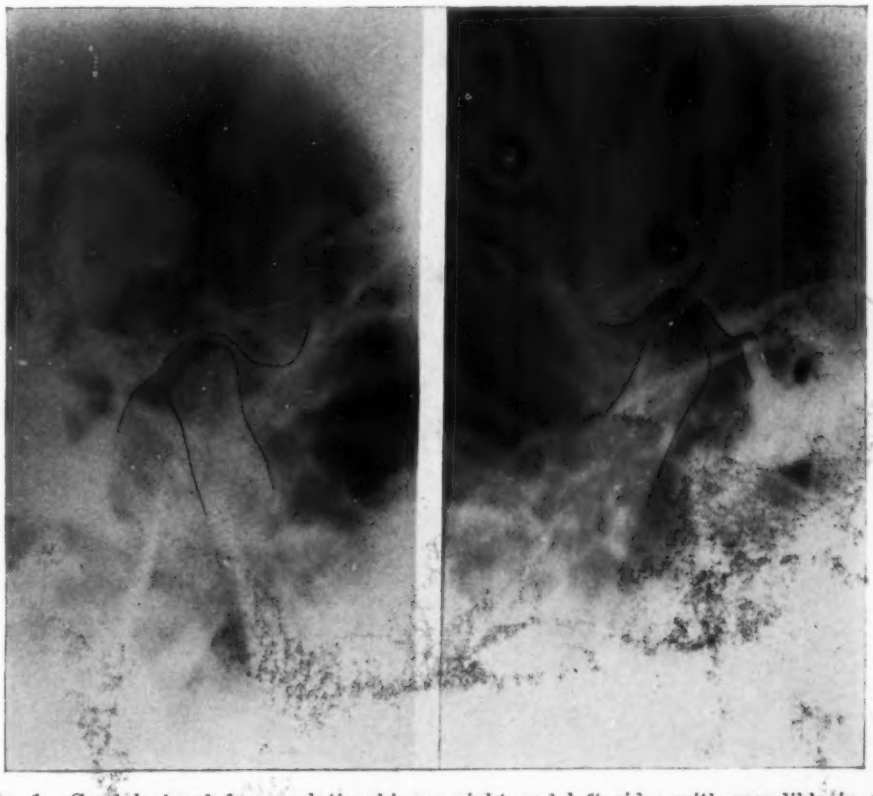


Fig. 1.—Condylar and fossa relationship on right and left sides with mandible in centric position which presents as a complete posterior occlusion after the mandible has functioned continuously in protrusive position of neutral occlusal relationship for four years.

When the condyle finally reaches its normal position, the distoclusion may be considered corrected, and it is found at the same time that the arches remain without effort in correct relationship." As to our ability to make the mandible assume a more advantageous position, every orthodontist of experience is well aware of years of attempts in countless thousands of cases which have relapsed as miserable failures in attempting to coax the condyle in distoclusal cases to function in a forward position until they will not be returned to their former resting positions. Of course, I am not questioning the sincerity of Dr. Rogers,

but I am questioning his interpretations. His radiographs show a joint formation at the beginning of treatment with well-developed fossae, eminentia well defined, and condyle head deeply seated. The final radiograph shows practically the same picture; intervening views show varying degrees of the condyle drawn down on the eminentia. As Dr. Todd has explained (even in the light of his knowledge as an anthropologist, research anatomical worker on growth, etc.), he would not attempt to commend or criticize any claim of results or manner of treatment where an attempt is made to stimulate mandibular growth—that the mandible acts like a will-o'-the-wisp in registering growth impulses. We may hypothecate different growth changes as having taken place. We noted change without treatment in certain cases from Stanton and Goldstein. But I maintain, as was stated by Dewey, that the mandible must be adequately developed if possible, but it must not be drawn forward. That it is quite fantastic to claim that muscular action through the pterygoids can influence joint formation to permanently change occlusal relationship in the manner as described. We can readily see a way to establish the lower dentition more anteriorly in a certain percentage of cases through mandibular alveolar growth, and this may suffice to establish neutroclusion. Yet, in a larger percentage, it will also be necessary to move the maxillary teeth posteriorly to establish neutroclusion. Stallard offers an excellent explanation as he states his belief for the failure of joint adaptation, wherein it is observed that the joints never became adapted

Fig. 2.

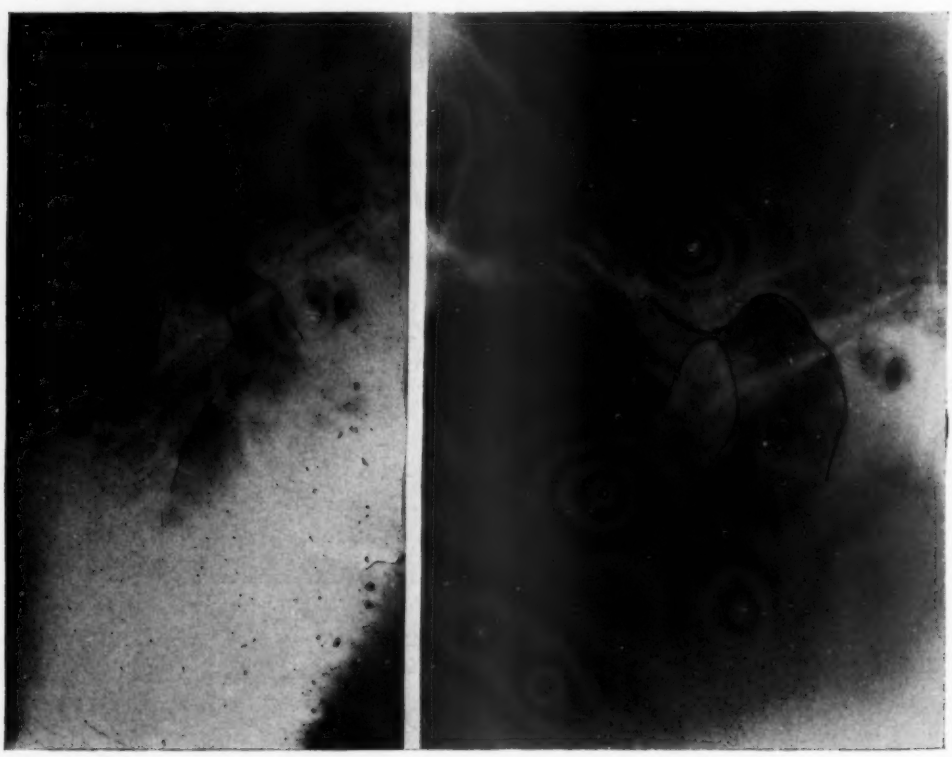
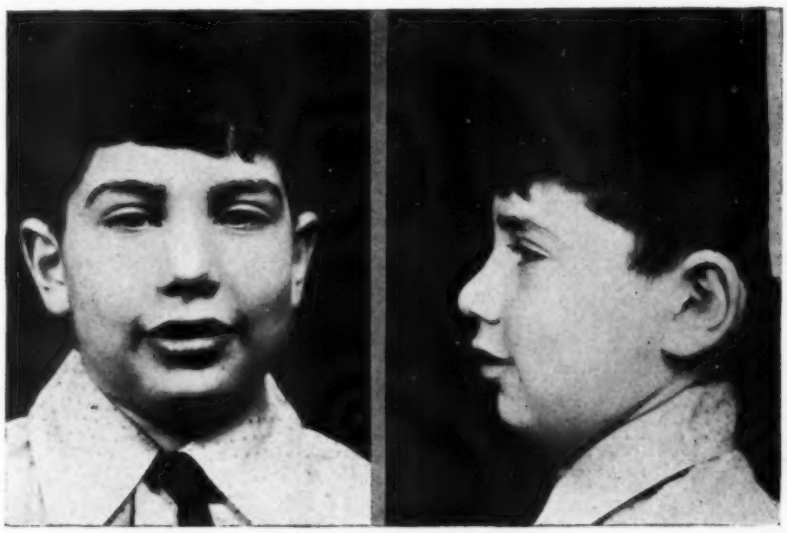


Fig. 3.

Fig. 2.—Showing condylar and fossa relationship of same case with mandible in protrusive position sufficiently to establish neutral occlusal relationship or the functional position for four years as readily maintained by the bite plane and by exercises as recommended through myofunctional treatment.

Fig. 3.—Showing condylar and fossa relationship of same case with mandible in complete protrusive position after four years of functional position as above described.

to the forward forced closures in cases of malocclusion in which the jaws were naturally forced into protrusion. It is, "the mandible, if forced into protrusive closure, before it will move laterally, returns the rotating condyle to its proper posterior position, while the advancing condyle moves forward and downward. Therefore, the original path of the condyle remains established, because in every lateral mandibular motion, the rotating condyle keeps the dorsal end of its path cleared. The rear end of the path is never given an opportunity to fill in new tissues to block the inevitable return of the rotating condyle."



A. *B.*

Fig. 4.—*A*, Front photograph of case at the beginning of treatment. Case is noteworthy to illustrate particularly the health of the child, the general satisfactory development as well as the evidence that jaw development is normal but that the one abnormality is essentially an innate mal-jaw relationship which is persistent, and satisfactory treatment is to be attained by procedures quite different than change in functional relationship or by the application of exercises to maintain same. *B*, Profile photograph at beginning of treatment.

A. *B.*

Fig. 5.—*A*, Photograph of same case after four years of change in mandibular functional relationship showing same general development as well as of jaw structures; but with same degree of distal relationship after four years of treatment. *B*, Profile photograph same time as Fig. 5-*A*.

You may well ask why this controversy involves time for treatment. Simply because, if, by any treatment whatever, myofunctional or appliance therapy, we could complete the treatment of distoclusions as based upon the theory that temporomandibular articulation is entirely subservient to occlusal relationship and could be guided in its formation by maintaining neutroclusion we could have all cases of this type *completed* during the mixed and transitional stages instead of finding it necessary *to begin* treatment at the later permanent dentition stage which is necessary as clinical evidence for years has conclusively shown. Also, in consideration of anteroposterior mal-jaw relations, as for Class III conditions, I feel that the time for treatment is as early as the mesioversion of any tooth, group of teeth, or of complete mandible to maxilla is evident and cooperation

Fig. 6.—*A*, Showing centric position of mandible with posterior occlusion persisting to same degree as was present four years previously. *B*, Showing functional relationship with mandible in protrusive position as continuously maintained for four years.

with the child is possible. I prefer earlier treatment here because of the very great likelihood that the mandible may become mechanically locked in severe eccentric positions protrusively; that it is readily made more severe by extrinsic causes, due to the anatomic structures being such that prognathisms are vicious in progression and also due to likelihood of early and severe traumatic occlusion. However, as for the final treatment of the true anterior mandibular version, I do not believe that occlusion can be changed to neutral until the permanent dentition stage.

Having explained my reasons for the belief that anteroposterior abnormalities in occlusion are decidedly unreliable in response to treatment during any stage prior to the final permanent dentition stage, I herewith place complete dentitions of deficient vertical alveolar growth in the same category. However, for regional alveolar deficiencies of either or both jaw processes, I have attained sufficient degree of satisfactory response to recommend treatment during the earlier stages, with the expectancy that some additional treatment may be needed to complete the entire vertical proportions at the permanent dentition stage. Research reveals that there is an accelerated period in vertical and lateral pro-

portions of the dentition during stage 2—per Hellman—a period of retardation during stage 3, and another and final stage of acceleration for vertical increase at stage 4. We find that this deduction is amply demonstrated in clinical manifestations. We should exercise decided reservations in attempting vertical development during stage 2 or 3. It is very important to attain any additional vertical proportions during stage 4; that is, as soon as the second permanent molars are sufficiently erupted to include them in an assemblage.

Concerning the advisability of treating numerous citations for perversions of tooth position and arch form irregularities with reference to the horizontal plane, the essayist has illustrated at length in accordance with my recommendations and has *shown wherein I believe the greatest desirability of earlier treatment* rests. I consider of particular importance the development of the premaxillary area which presents a decidedly retarded developmental potential since its vestigial character in man is due to the reduced size of the masticatory apparatus and the consequent retrogression in the development of the facial part of the skull; its reduction alters the size of the nasal aperture. We are thus concerned with the crowded eruptive positions of permanent incisors in a decidedly deficient area which, in my experience, offers the outstanding condition for desirability in applying stimulation to promote growth as soon as it is evident that one or more permanent incisors are erupting in a decidedly crowded area.

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CONSTITUTIONAL ASPECTS OF ORTHODONTIC PROBLEMS

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THE approach to the problems presented by orthodontic etiology, diagnosis, and therapy has usually been made by drawing conclusions from individual observations which were assembled and coordinated for such a purpose. Only occasionally the opposite way has been tried: that is to draw conclusions from general principles. I have made such an attempt by introducing constitutional types into orthodontics in a previous report in this Journal some years ago. I first had presented the leptosomic, pyknic, and athletic types, as developed by Kretschmer, before the Dresden Meeting of the German Orthodontic Society in 1927, but at that time there was not much more than a vague idea behind the demonstrations. The fact was stressed that with each body type is connected a specific profile form, and the possibility that the constitutional angle-profile of the leptosomian with its receding mandible, though not necessarily involving a distoclusion, might be disposed to it. Likewise the peculiarity of the athletician's profile seemed to indicate a tendency toward prognathism of the mandible, whereas the straight profile of the pyknician could be easily detected as the golden rule profile of the textbooks which was to be forced upon our patients indiscriminately and without regard to differences in their constitutional appearance. It is now interesting to note that orthodontic investigations which have since been carried out from constitutional viewpoints have proved the existence of relations anticipated at that time.

HELLMAN'S THREE FACIAL TYPES

Hellman, in the course of his investigations, came to describe three facial types which he first presented in photographs and afterward in generalized schematic sketches. I had a feeling of high satisfaction when I first saw these tracings, for one need only glance at them to realize the relationship between the facial types evolved by Hellman and those which I had picked out of constitutional literature as the most suitable ones for our purposes (Figs. 1, 2, and 3).

Hellman, too, states that though, "We are likely to be partial and judge such facial profiles by the look of the chin," these pictures were of "young adult males with dentures in normal occlusion." It follows, therefore, also from Hellman's investigations that these types are normal though extreme variations of facial forms.

BRITISH MEDICAL RESEARCH COUNCIL'S INVESTIGATIONS: CHILDREN WITH DISTOCLUSION ARE TALLER

There remains the problem to prove the predicted tendency that the leptosomian with the angle-profile is liable to distoclusions. This proof has been furnished—unintentionally but nevertheless convincingly—by Young, Johnson, Smyth, and Still in their publication, "Investigations Into the Nature and Characteristic Features of Postnormal Occlusion." These authors make

the following statement in the preface: "Corrective measures are said to be indicated in extreme cases, not only for esthetic reasons but also because of the supposed functional disability in mastication; in the children examined, however, such disability did not seem to have a material effect upon general growth, as those with abnormal occlusion were significantly taller than the normal." This is not a discussion of whether tallness is really a test of "ability of mastication" or development as is the tacit assumption in this sentence. But the conclusion which may be drawn, nevertheless, is that children with postnormal occlusion are taller than those with normal occlusion. The authors come back to this peculiarity once more in the course of their publication: "It should be mentioned here that it was first assumed that the measurements of the characters in groups of children of the same sex at corresponding ages with normal and postnormal occlusion would be quite comparable, as there was no reason to suppose that a selection from the same schools, based solely on whether children showed normal or post-normal occlusion, would result in groups materially different in average stature." These differences between the two groups prove to be as high as 3 to 6 cm., according to their tables.

Fig. 1.—Facial profile photographs of three boys with the same type of malocclusion, showing difference in effect of malocclusion and of result after orthodontic treatment. (After Hellman, *Dental Outlook*, June, 1938.)

BIZYGOMATIC BREADTH AS CONSTITUTIONAL INDICATOR

We were able, so far, to justify our choice of constitutional types and to corroborate our idea that patients with distoclusion are of a special type of which tallness is a peculiar feature. Is this difference, significant though it is, sufficiently strong to identify this special type with the leptosomian as has been our assumption? We know that the leptosomian is characterized by a diminished growth in breadth in combination with an undiminished or even increased growth in length. Table I shows these differences numerically: the leptosomian, though taller, is of less weight than the pyknician in which the relation is inverted: he is smaller but heavier. Yet still more interesting and

TABLE I

MEASUREMENTS OF HEIGHT, WEIGHT, AND BIZYGOMATIC BREADTH IN LEPTOSOMIC AND PYKNIC MEN (AFTER KRETSCHMER)

	LEPTOSOMIC MEN	PYKNIC MEN
Height	168.4 cm.	167.8 cm.
Weight	50.5 kg.	68.0 kg.
Bizygom. breadth	139.0 mm.	143.0 mm.

TABLE II

MEASUREMENTS OF HEIGHT AND BIZYGOMATIC BREADTH IN LONDON BOYS WITH NORMAL AND POSTNORMAL OCCLUSION (BASED ON FIGURES OF YOUNG, JOHNSON, SMYTH, AND STILL)

AGE	HEIGHT IN NORMAL BOYS	HEIGHT IN POSTNORMAL BOYS	BIZYGOMATIC BREADTH IN NORMAL BOYS	BIZYGOMATIC BREADTH IN POST-NORMAL BOYS
8	123.95	126.96	119.99	119.03
9	128.67	133.07	121.44	118.73
10	133.90	137.31	122.70	120.21
11	137.05	142.38	123.71	121.99
12	142.30	146.12	125.55	124.49
13	145.93	150.09	125.73	125.26

elucidating is the inverse relation between height and bizygomatic breadth. This inverse relation, seen in Table I, may also be clearly seen in Table II and confirms our opinion that this postnormal group is composed of children of a more leptosomic habitus.

I shall not repeat here what has been said in favor of this bizygomatic breadth measurement, too, in the above-mentioned report. It shall only be stated here once more that there exists a definite relation between the breadth of the palate at $\underline{6 \mid 6}$ and the bizygomatic breadth. (This has been tested, too, by Smyth and Young in their former investigation, "Facial Growth in Children.") On the other hand, there exists a relation between the bizygomatic breadth and the constitutional type and, in my opinion, this measurement may prove to be one of the best indicative symptoms of the habitus. For, whereas generally in taller persons other measurements should be greater too, in leptosomians the bizygomatic breadth is smaller than it should be in relation to the shorter pyknician, and this inverse relation is due to the diminished growth in breadth as the characteristic feature of the leptosomic type.

WEIGHT

On the contrary, there exists in both types a direct relation between bizygomatic breadth and weight. This characteristic feature is displayed in Table I. It was found by Smyth and Young, too, striking the authors "rather unexpectedly": "Reference has already been made to the fact that the intensity of the association between many of the facial characters and the body weight was found rather unexpectedly to be at least as high as, if not higher than, that between the corresponding characters and either age or stature. This feature does not obtain invariably in regard to the characters which were tested, but the tendency is clearly shown in all three groups, children from 2 to 5 years, boys from 8 to 14 years and girls from 8 to 14 years, and appears to hold for such measurements as the zygomatic breadth and the palatal height as well as for the measurements seen in profile." Details

may be seen in Table III. That the relation between breadth measurements and weight exists already at a still earlier stage, i.e., in infancy, was found by Harry and Ruth Morris Bakwin. In 100 newborn infants, they calculated a correlation index between the maximum breadth of the palate and weight as high as 0.56 and between cephalic breadth and weight as 0.55, these values being the highest among twenty-six calculated indices. From these facts we may gather that (1) constitutional relations are existent and recognizable as early as in infancy (Fig. 4) and that (2) weight is an important factor in constitutional observations and considerations. (Weight is an integral part in constitutional indices as in the Pignet and Pirquet indices, for instance.) Therefore, once we have decided upon a more constitutional aspect of orthodontics, the high relationship of some measurements with weight will not puzzle us, but, on the contrary, may be utilized as a helpful indicator.

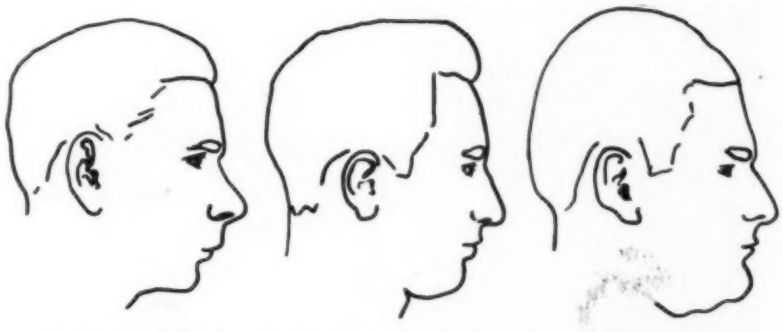
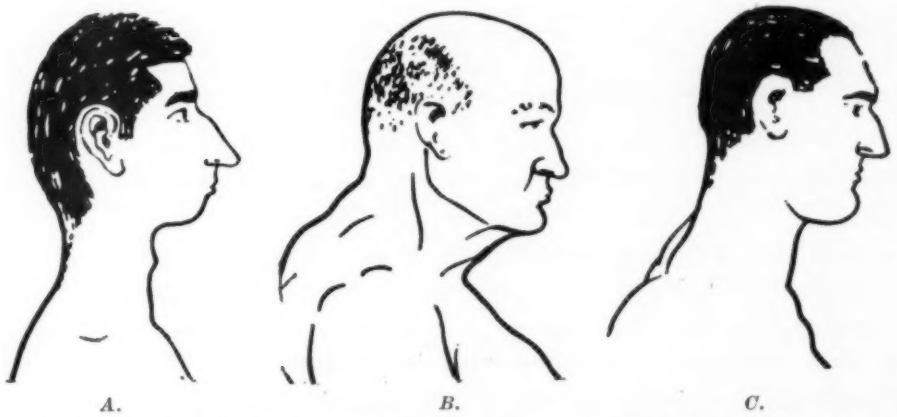


Fig. 2.—Facial outline of tracings from photographs of three young adults having the full complement of teeth in normal occlusion, showing differences in types. (After Hellman.)



A. *B.* *C.*

Fig. 3.—Profiles of Kretschmer's types: *A*, leptosomian; *B*, pyknician; *C*, athletician. (After Kretschmer.)

WEIGHT AND WIGGLE

The close relation between weight and bizygomatic breadth is also recognizable in investigations recently published by Hellman. Hellman has devised a new sort of diagram, the "wiggle of face." Whereas his already well-known profile diagram—as indicated by the name—gives only the profile measurements of the face, this ingenious new device provides us not only

with the facial measurements in all three dimensions, but also with the statements of age, height, and weight. This wiggle, therefore, furnishes any constitutional-minded orthodontist with ready-made material. If we examine the twelve wiggles published in a recent article, we shall find that in all but one the bizygomatic breadth swerves to the same side as weight does, i.e., if there is a deviation of weight to the plus side, the bizygomatic breadth will deviate to the same side and vice versa. There is only one wiggle where this relation does not show. In this case the measurement of weight is an extremely high one and exceeds even the normal range of variation at a substantial extent. Though one exception among twelve examples is no serious affair, it might be ventured with due reserve that this wiggle represents an individual with a metabolic imbalance owing to an endocrine disturbance (Fig. 5).

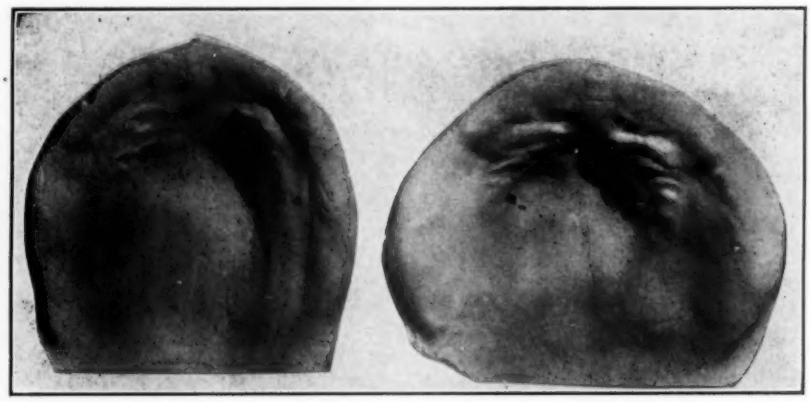


Fig. 4.—Palates of two male newborn infants showing wide variability in palatal form. (After Bakwin and Bakwin.)

NORMAL OCCLUSION AND SUPRANORMAL BIZYGOMATIC BREADTH

From Hellman's same publication the interesting role of the measurement of the bizygomatic breadth may become still more evident. In a table showing the dimensions of sixty-two individuals with normal occlusion, 77 per cent of the measurements of the bizygomatic breadth are within the normal range of variation, 5 per cent outside on the minus side and 18 per cent outside on the plus side, thus leaving a balance of 13 per cent on the plus side. In a table, however, showing twenty individuals with Class II, Division 1 malocclusion, 35 per cent fall within the normal range, 35 per cent are on the minus side and 30 per cent on the plus side, leaving a balance of 5 per cent on the minus side. I regard these features as so important that I shall give them once more with Hellman's own commentary: "Thus as shown in bizygomatic width, 77 per cent of the dimensions are normal and 23 are anormal. But of the twenty-three which are not normal, five are smaller and eighteen larger than the normal. If the five smaller dimensions should cancel five larger ones, then there still remains a difference of 13 per cent of cases which are greater in bizygomatic width. The conclusion then is that asymmetries are significant, because they indicate certain trends or tendencies. In

TABLE III

CORRELATION BETWEEN BIZYGOMATIC BREADTH, STATURE AND BODY WEIGHT IN BOYS AND GIRLS AT AGES 8 TO 14 YEARS (AFTER SMYTH AND YOUNG)

BOYS				GIRLS			
No.	Full stature	No.	Body weight	No.	Full stature	No.	Body weight
554	0.549 ± 0.030	551	0.625 ± 0.026	584	0.637 ± 0.025	585	0.690 ± 0.022

this case the tendency is toward a broader face. Furthermore, as noted in the last column in Table I, there are asymmetries of other features, too. To be sure none of them are as marked as that in bizygomatic width." This quota-

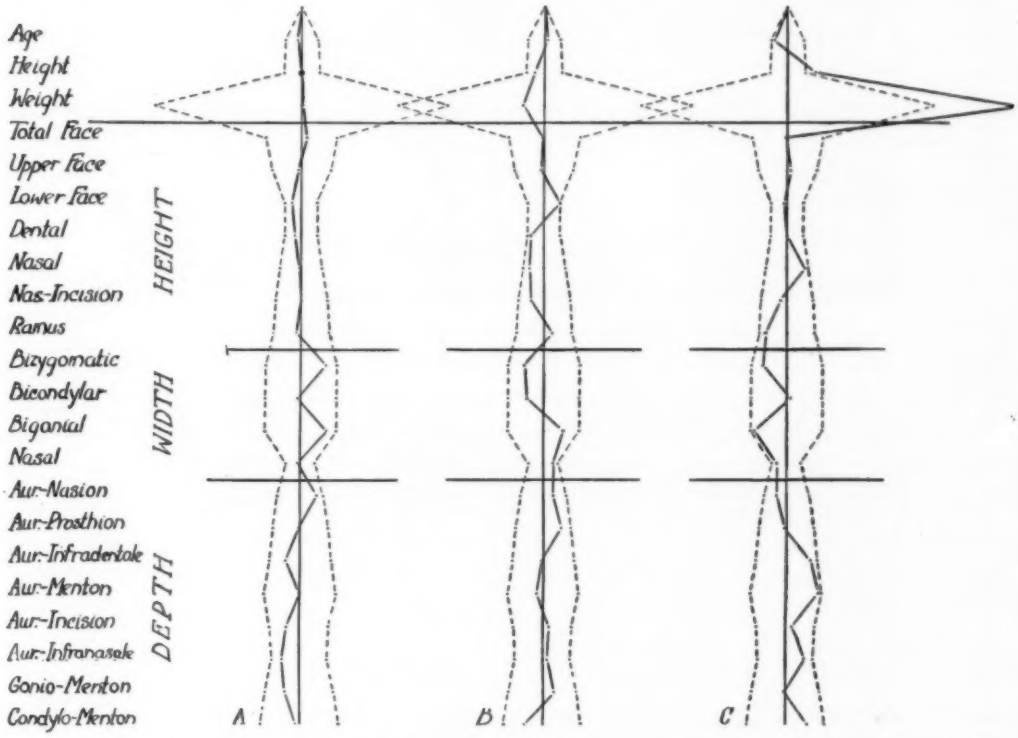


Fig. 5.—Wiggles of facial features of three individuals with dentitions in normal occlusion, showing no deviations outside the normal limits. (After Hellman.)

tion was with regard to the group with normal occlusion. For the group with distoclusion Hellman's commentary reads as follows: "In bizygomatic width, for example, the anormal is higher (65 per cent) than the normal (35 per cent). Thus the number of the normal in bizygomatic width on the one hand is extremely low (35 per cent of the group) and equals that of the subnormal. . . . The asymmetries favoring supernormal are in height alone (total face, upper face, and nasion-incision), and those favoring subnormal are in width and depth. . . ." And when summing up, Hellman, once more, is forced to state the somewhat strange behavior of the bizygomatic width: "The percentages of the differences are low, that of bizygomatic width (13 per cent) being the highest." Here, Hellman cannot but try to give some explanation for this peculiarity of the bizygomatic width, and we find it in a footnote: "If any significance is to be attached to this, it would rest with the explanation that wide zygomatic arches indicate robust temporal muscles.

Adding such muscles to dentitions in normal occlusion, it just points to better mastication. This, however, is not the rule since it occurs only in 13 per cent of cases." But, shortly before, Hellman had said: "The conclusion is that asymmetries are significant, because they indicate certain trends or tendencies. In this case the tendency is toward a broader face." We think this explanation is the better one. For, if we regard the bizygomatic breadth as an indicator of the constitutional trend, then there is no uncertainty about the real meaning of this measurement's irregularities: In the group with normal occlusion exists a tendency toward a pyknic constitution, and the general broadness of this type—the jaws participating in this trend too—allows for a correct positioning of the teeth.* In the group with distoclusion, however, a tendency toward leptosomism is indicated by the shifting of the values from 13 per cent on the plus side to 5 per cent on the minus side. Hellman's investigations, therefore, confirm our concept of the leptosomic type's disposition toward distoclusion as did the investigations of Young, Johnson, Smyth, and Still.

CONSTITUTIONAL LIMITATIONS OF TREATMENT

These connections being established, we may ask: What may we gain from it? Is it worth while to bother so much about type, weight, and bizygomatic breadth as has been done here? There is no doubt that the study of etiology will get some new impulse. This could be gathered already from the above-mentioned facts. But I think that therapeutic procedure will profit still more. The three boys shown in the upper row of Fig. 1 had the "same type of malocclusion" (Angle Class II, Division 1). They underwent orthodontic treatment which was successful in all three cases, but their reaction as to facial changes was not homologous as is shown in the pictures below. Hellman concludes: "To me this evidence just proves what can be done with appliances; namely, restore to normal the occlusion of the teeth. What happens to the face, in addition to that, is neither predictable nor controllable." Perhaps the first practical gain when approaching orthodontic problems from a constitutional viewpoint would be that we face the prognostic difficulties as to more or less favorable facial changes with less resignation. On the other hand, when valuing the influence of our mechanistic treatment upon growth and development of the face, we shall have to employ much more resignation than was and is usually done. The part of the face which attracts our foremost attention is the mandible. In Angle Class II, Division 1 cases, it is usually influenced by our treatment toward a forward development in order to "restore" its "normal position." This effect of treatment, therefore, had to be expected in Hellman's three cases pictured in Fig. 1. But in *C* though normal occlusion was attained, no forward development of the mandible took place. If we study Figs. 6 and 7 and put them into relation with the patients in Fig. 1, the explanation offers itself: Type C shows the typical "angle-profile" of the leptosomian which comes about by two contrasting features,

*Another indication for the existence of sufficient space in this type is the diastema between the maxillary central incisors which we so frequently find in pyknicians. If the teeth are small, an excess of space may easily come about, leading to the formation of diastema also between other teeth. The well-developed mandible in pyknicians may also account for the frequent appearance of an edge-to-edge bite in these types.

namely the prominence of the middle-face with the nose on the one side, and the receding of the forehead and the mandible on the other. Support for my classing the patient in Fig. 1, *C*, as leptosomian is furnished by his long neck which is also a typical leptosomian feature. Since in these types the mandible is shorter,* to bring it into a so-called normal position would have meant a treatment against the type. On the other hand, the patient in Fig. 1, *B* has the very look of a true pyknician (note the short neck as against the long one

Fig. 6.—Girl of the leptosomic type. Note the characteristic long neck.

Fig. 7.—Girl of the pyknic type. Note the short neck.

in *C*). In these types a distoclusion may often be traced down to mechanical causes, e.g., habits as *thumb-sucking,* and it may easily be cured and retained. In type *C* representatives, however, the distoclusion is connected with the type and here prognostics are not so favorable, and we have to think of possible failures.†

CONSTITUTION AND FAILURE

Failures, for obvious reasons, are seldom published. But in the symposium given before the New York Society of Orthodontists by Rogers, Mershon, and Hellman, the latter has reported a Class II, Division 1 case which after a successful treatment did relapse into its initial state within some years.

*"Shorter" has here only the meaning of shorter of appearance. Whether it is really shorter or of normal dimensions and only in a more backward position shall not be discussed.

†Hellman himself hints at constitutional backgrounds when discussing the differences in the outcome of these treatments: "We may not cherish the first and may boast of the second, but we have as yet to realize that the outcome in both is limited by the potentialities of individual development."

Since only pictures of the models are given and none of the patient, we have no clue as to his type. But it would be interesting to know whether this case did concern a distinct leptosomian. For it should always be borne in mind that all the above-considered arguments are with regard to really well-developed leptosomic types. An ideal leptosomic and also pyknic type will probably be as seldom encountered as an ideal "normal occlusion." Nevertheless, there are individuals which come very near to perfection, displaying an abundance of characteristic features. And these individuals deserve our fullest interest. In my opinion, the usual treatment of enlarging the maxilla and bringing the mandible forward should be discarded here and an adaption of the maxilla to the constitutionally shorter mandible should take place. For in these types, according to their general narrowness, the facial skeleton with the maxilla, too, is of a narrow build and it is contraindicated to widen it to such an extent that the teeth with the processus alveolaris are moved away from their bony foundation and the structural relation becomes upset. Every orthodontist has experienced the collapse of widened arches. But in these cases, arches have not been widened but overwidened. It is here that the usefulness of the bizygomatic breadth—molar relation to which I have referred above becomes evident. We have seen that the measurement of the bizygomatic breadth is a constitutional indicator, and since there is a numerical relation of 3:1 between the bizygomatic breadth and the molar distance (measured between the centers of the first maxillary molars), we are warned at once that the breadth of the arch is suited to this narrow facial skeleton. Widening would only disturb this constitutionally determined relation and provoke a relapse once the period of retention is over and the free play of forces restored. Therefore we can only resort to extraction, if we want to score a lasting improvement. Fig. 8 shows a case treated according to these principles, contrasted with a treatment in a leptosomic type in Fig. 9.

CONSTITUTIONALLY INDICATED EXTRACTION

I am aware that orthodontists of high authority, following the principles laid down by Angle, up to now violently oppose extraction as a justifiable procedure in orthodontics, but I think the introduction of constitutional viewpoints should lead to some understanding in this acute issue. Perhaps Mershon's recent statement might pave the way in this direction. In his lecture, "Significance of the Angle School," he said, "Aside from the extraction of third molars, only a very small percentage of our cases warrant extraction as a remedial measure." Whereas the small percentage of cases which warrant extraction may gladly be recorded as a first concession from the side of this highly authoritative opponent of extraction, it might be interesting to discuss the remark about the third molar and its extraction in the light of constitutionalism. It has become the usage to extract third molars during or even before eruption (enucleation) lest they might disturb once again the newly created order of the treated denture. The underlying idea is that, because of lack of space in the posterior regions of the jaws, the wisdom teeth will not develop normally and will bring about pressure upon the row of teeth before them, thus disarranging them once more. We are inclined to think that such a

"lack of space" will occur especially in the narrow jaws of the leptosomian, the shortness of the mandible adding another causative moment. To elucidate the actual conditions, we turn once more to one of Hellman's thorough investigations, this time about wisdom teeth. Table IV presents two groups of male students, the one with unerupted, the other with erupted third molars. Hellman, in his table, had compiled only age, height, and weight. I have supplemented it by the measurements of the bizygomatic breadth from another table, and we are able to realize at the first glance that group B students with present but unerupted third molars present all the features which, as

Fig. 8.—Class II, Division 1 case in girl with leptosomic features. This patient was treated with extractions in the maxilla.

Fig. 9.—Class II, Division 1 case in pyknic girl. This case was treated without extractions.

we have seen above, are characteristic of the leptosomian type. Though they are taller, their bizygomatic breadth is smaller, as is their weight. That indicates third molars will easily erupt in pyknicians with their broad, roomy jaws; they are liable to impaction or retarded and difficult eruption in the

narrower jaws of the leptosomian. With these new facts in mind, we turn back to Mershon's remark and ask ourselves: Why not extract the first premolars right in the beginning, after careful diagnosis and due consideration, and thus shorten and facilitate the treatment when, on the other hand, after a complicated and lengthy treatment, teeth, i.e., the wisdom teeth, will have to be extracted anyhow? . Fig. 10 shows a case which has been treated from this point of view. There was a Class II, Division 1 anomaly with the additional feature of both the second mandibular premolars impacted and the spaces nearly closed. Though extraction generally is disputed and, in cases of distoclusion, according to orthodox principles, extraction in the mandible is especially and strictly prohibited, I decided upon the extraction of both the mandibular first premolars. Judging the results, we shall find that though the mandible has remained within its constitutionally prescribed position, the profile is nevertheless improved. Likewise a very satisfactory occlusion has been attained, though the complement of teeth has been reduced, i.e., adapted to the short mandible which may pave the way to an undisturbed eruption of the third molars.

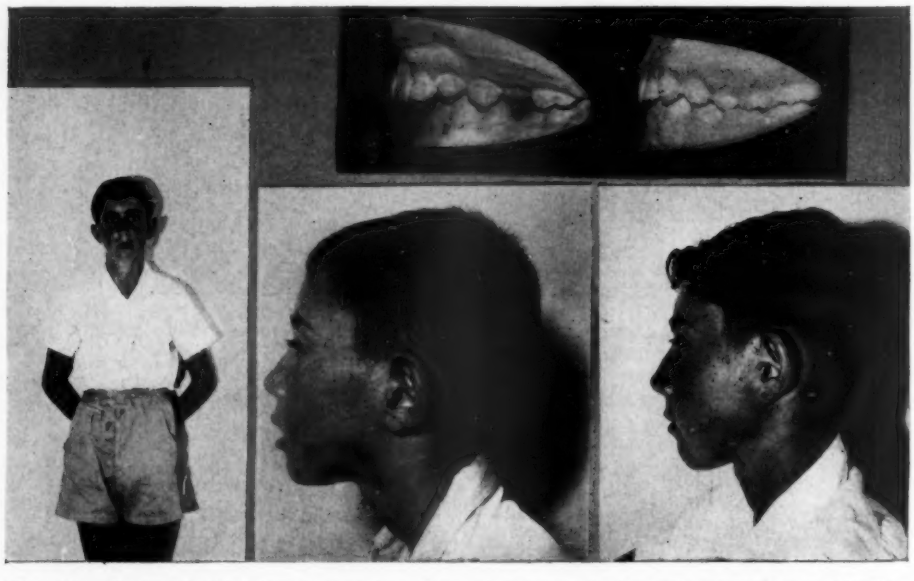


Fig. 10.—Class II, Division 1 case in a boy of general leptosomic appearance blended with slightly hypoplastic features. The mandibular second premolars were impacted, and the patient was treated with extractions in the mandible.

I should not like to be understood to recommend in Class II, Division 1 cases extraction in the mandible generally. But in patients with broad teeth,

TABLE IV

COMPARISONS OF COLUMBIA UNIVERSITY STUDENTS (MALE) GROUPED ACCORDING TO PRESENT AND UNERUPTED THIRD MOLARS

	GROUP A (58) 4 THIRD MOLARS PRESENT AND ERUPTED		GROUP B (17) 3 OR 4 THIRD MOLARS PRESENT BUT UNERUPTED	
	Average	S.D.	Average	S.D.
Age	23.21	2.30	21.94	1.92
Height	68.98	2.67	69.12	2.22
Weight	162.99	22.50	154.88	8.82
Bizygomatic breadth	140.95	5.70	139.18	5.94

such a procedure will give better prospects as to the maintenance of successful results. For the anterior teeth will be saved from subsequent crowding caused by the pressure of third molars without sufficient space for development. From Henry's article, "Prophylactic Odontectomy of Third Molar," we may learn the opinion of an exodontist regarding this point: "It is a regrettable fact that the molar teeth have not been reduced in size to accommodate themselves to the phylogenetic shortening of the snout. In jaws of small size, therefore, in which the molar teeth happen to be disproportionally large—and the third molar is sometimes very large—impaction of this tooth is inevitable."

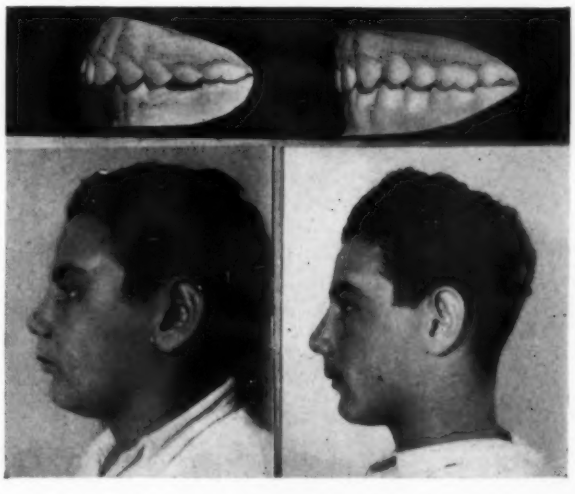


Fig. 11.—Anomaly of similar type as in Fig. 10, in boy with leptosomic features. Though this patient was treated without extractions, the face shows the same lack of facial changes, the number of teeth being of much less importance than the constitutional factor.

PREMATURE EXTRACTION AND SPACE RETAINER

In this connection one must also mention that closed or half-closed spaces need not always be the results of premature losses of deciduous teeth. A case as that in Fig. 12, for example, will all too easily be classed as anomaly caused by premature loss of deciduous teeth whereby "loss" has generally the meaning: loss owing to decay or extraction. But if we look at the model in Fig. 13, we may learn that this need not be the case and that such an anomaly may develop on an entirely different base. The maxillary central incisors are extremely broad and have occupied nearly all the place formerly used by the four deciduous incisors together. Therefore, the lateral permanent incisors in the course of eruption are pushing the deciduous canines outside and have almost established contact with the first deciduous molars. It is a developmental stage of a type of anomaly of which Fig. 12 represents the final stage and is at that time attributed to premature loss of deciduous teeth, but as we have seen, erroneously. Of course, there is a premature loss. However, it is not caused by decay or untimely extraction, and no space retainer could have possibly arrested the development of this anomaly. For the cause is deeper rooted; it is the disrelation between broad teeth and a constitutionally small jaw. (I have not previously used the frequently employed phrase "nar-

row jaw of the leptosomian" since this sort of anomaly is generally to be found in another constitutional type or perhaps better, subtype which will be treated only in the end of this article, namely the "type cérébral" of the French constitutionalists.)

It seems that observations and considerations of this kind might be apt to explain to some degree the divergency of ideas regarding space retainers. Though I have not yet at my disposal sufficient evidence from my own investigations nor hints from the literature to warrant this theory, it is quite possible that in children of a more pyknic type, with sufficient space in large jaws, retainers are superfluous, and the observed and reported cases of naturally retained or even reopened spaces might have occurred in these types, too.

Fig. 12.

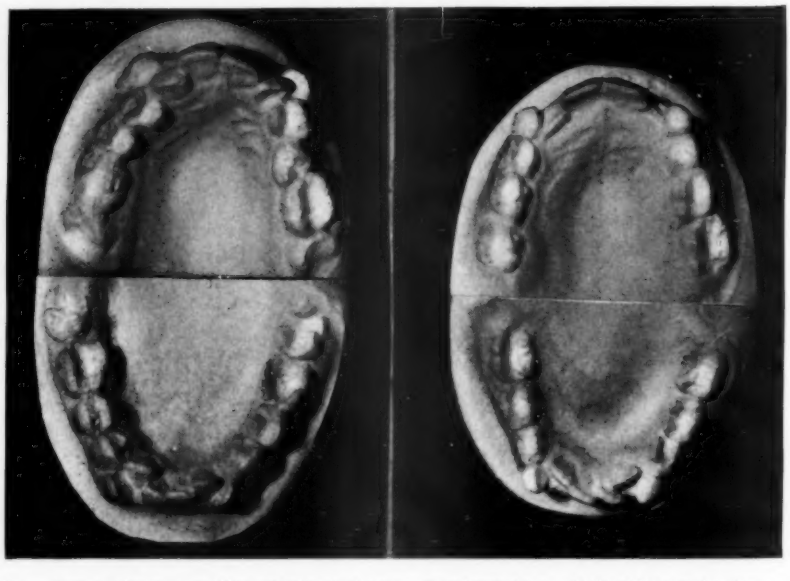


Fig. 13.

Fig. 12.—Anomaly generally attributed to premature loss of deciduous teeth.
Fig. 13.—Developmental stage of same type of anomaly shows that the real cause is disrelation between size of teeth and jaws.

On the other hand, in cases of small jaws a sort of "struggle for life" will take place. The teeth best favored as to time of eruption and situation of the bud will occupy the limited area which is at the disposal of the whole set and will leave the less favored rest to their fate, i.e., to erupt outside the arch or not to erupt at all. Under such circumstances the insertion of space retainers cannot provide more place; that means sufficient space for the whole set, but it will only be able to reserve place for some teeth at the cost of some other teeth.

EARLY TREATMENT

Under these conditions, it remains the question whether it is of any value at all to initiate treatment at early stages of development. The enthusiasm with which early treatment has been regarded, only some years ago, has gradually given place to calmer feelings, and out of the number of criticisms, I want to quote some of Taylor's remarks: "Fifty per cent of the children under 9 years of age who are wearing orthodontic appliances do not need them. The appliances may be doing harm instead of benefiting the individual

wearing them. . . . After thirty years' experience, the above statement is my sincere conviction. . . . During the reign of Dr. Bogue's theory, I have had occasion to call on many of my orthodontist friends. In the reception room and in the chair I have observed a number of small children from 4 to 7 years of age, who looked like a lot of little bull dogs. Their arches were expanded 'high, wide, and handsome.' I had them in my practice too, but some of the most distressing cases of adult malocclusions I have ever had followed such treatment. . . . One hears much about bimaxillary protractions in this modern orthodontic period. While searching for material for this paper, I have had occasion to go over the histories of many cases of young children that I have treated during the deciduous or transitional stage of dentition. To my surprise I found that in every case in which I had treated early, I had a bimax-

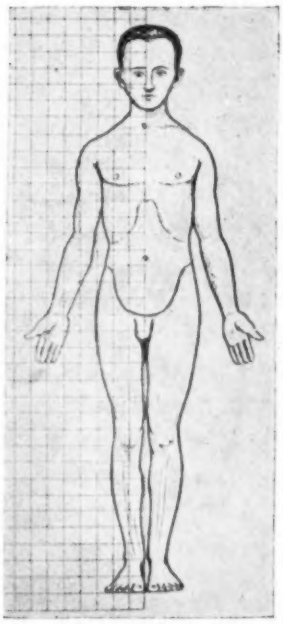


Fig. 14.—"Type cérébral" of French school of constitutionalists. (Sigaud, Chaillou, Mac Auliffe.)

Fig. 15.—Profiles of children of cerebral (hypoplastic) type. Diagnosis of this type is difficult in children and may be facilitated by a bulging of the back of the head in its upper part which the author frequently observed in this type and which gives the profile nearly the form of an upright right-angled triangle.

illary protraction to contend with in the permanent denture. This brings up a question for you to consider very earnestly. Did my early treatment have anything to do with producing the protraction or not?''

Constitutional aspects might shed light on these objects, too: Early treatment is generally considered necessary and initiated when, at the age of 4 to 6 years, the normal spacing between the deciduous incisors does not take place, or, at the age of 6 to 8 years, when lingually erupting lateral permanent incisors do not find their way out of this developmentally normal position into their final place within the arch, owing to lack of space. These shortcomings were regarded as disturbances of growth and development which had to be corrected by widening the arch, thus giving the jaws their normal width. But this conception, in my opinion, is an erroneous one and takes the effect for the cause. The lack of space and the narrowness of the jaw are not due to faulty development or to a disturbance in growth (though this may be the case, too, in patients who underwent severe and protracted illness during early childhood), but owing to the constitutional pattern of the individual, the narrow jaw is too small to accommodate all the teeth it should at that given time if these teeth are too big. For such a disrelation, the above described symptoms are the first indications at an early age. At a later period, abnormally erupting canines and premolars are symptoms of the same discrepancy, if no treatment has taken place. But if there was a treatment, we should see a toothy mouth (children who look ''like a lot of little bull dogs'' in Taylor's description), i.e., an overwidened and protruding denture, because otherwise the full complement of teeth could not have been accommodated. The final picture such cases of disrelation present, if there was no extraction at any stage, is the relapse, eventually in combination with impacted third molars. Of course, the picture described here and the conclusion drawn refer only to extreme cases of disrelation between general narrowness and big teeth.

ORTHODONTIC ASPECTS OF CONSTITUTIONAL PROBLEMS

The question now arises whether we are able to judge the general body habitus already at a sufficient early state and whether the type at all will always be discernible and easy to identify. It has repeatedly been said that constitutional considerations are only important in cases in which the patient's habitus is near to an extreme embodiment of some type or other, and in these cases the general trend will already be recognizable during childhood and adolescence. Since in cases of extraction, we nearly always extract premolars, and these teeth only erupt at 10 to 12 years of age, typical features will be sufficiently developed to warrant such a responsible decision. On the other hand, the size of premolars is varying too, and extremely small ones may sometimes make good for broad incisors, and thus extractions may become unnecessary. Waiting for the unfolding of the type and for the eruption of the premolars should be among the weighty arguments against early or, better, all-too-early treatment.

As to the distinction between the different types, I have confined myself generally to the tall and narrow leptosomian and the broad pyknician, though

I, at first, presented still a third type: the athletician. The reason is that, of late, this type has become an object of discussion, namely whether it is really an independent type of the same order and importance as both the former ones. It goes without saying that to us the athletician seems to be of special interest since his profile is characterized by the strong development of the mandible which brings him at once, in our mind, in connection with mesioclusion, in the same way as we could prove the connection between the leptosomian and distoclusion and reveal the use of pyknic face types as norm standards that, of course, imply neutroclusion. Though this may be and though this would mean an ideal correspondence with Angle's classification, I, nevertheless, came to the conviction that it is better to make only one principal decision according to the general narrowness of the leptosomic or the broadness of the pyknic (euryrisomic) type. The athletician would thus become a secondary type and the prevalence of pyknic to leptosomic features would lead to classifications like generally pyknic habitus with athletic features, or generally leptosomic habitus with athletic features. To bring about some harmony in our system it would be good to contrast the pair of primary types with a pair of secondary types. Thus the athletician with his strong, sometimes clumsy features might be complemented by an opposite type. This type offers itself in the "type cérébral" of the French school of constitutionalists (Sigaud, Chaillou, and Mac Auliffe). The reason why I did not use the four types of the French authors right from the beginning—the other three types roughly corresponding to Kretschmer's three types—was the difficulty presented by this very "type cérébral." This type is characterized by the dominance of the forehead which is high and steep, sometimes even bulging, over the rest of a rather short face. The profile, therefore, makes an impression of flatness, since, besides this, neither the small nose nor the lips nor the chin show any tendency to protrude. Especially the lacking of a furrow between lower lip and chin should be of interest to the orthodontist. In addition to these facial features, the body, generally, is of gracile appearance, too, and the measurements of height are the smallest of all types of the French school. What distinguishes this type from the rest of the types is that its main characteristic, from which, therefore, also the name is derived, is a peculiarity of the head, whereas the other types are characterized and distinguished by different trends of their general body development and only, so to speak, incidentally present different facial appearances also. This condition may have led Kretschmer to regard this type not as an independent and fundamental one, but to group it together with some other less important types in a separate class of "dysplastic types." For in my opinion the "type cérébral" corresponds fairly well to Kretschmer's "hypoplastic type," face and body being in a generally hypoplastic state; only the cranium is well developed, and this gives the forehead its prevalent, dominating appearance. But it is this very feature which makes the use of the type so difficult, since it is clearly discernible only in persons nearing adulthood. Adults of this type make a somewhat infantile impression, and should it not sound preposterous to speak of "infantile children"? Children are

naturally of gracile physique, and, as to the forehead, its size is always proportionally greater in the juvenile than in the mature individual. Therefore, when investigations were made in Vienna on infants to determine their distribution among the different types, the "type cérébral" scored the highest percentage (24.4 per cent) though in adults its frequency was very low (ca. 4 per cent). This curious result will not astonish us so much as it will stress once more the difficulties to be encountered in working with this type in children or adolescents. When I now, nevertheless, propose to include this type in our constitutional system, it is for the reason that, at last, I came to the conviction that it will aid us in dealing with the special problems presented by it in our practice. Therefore, this type may stand in contrast to the athletic type and, thus, complement the pair of secondary types. But the special problem this type may present in practice—it is easy to guess—will be the possible appearance of a full complement of big-sized teeth in jaws which are subjected to its general hypoplastic trend. Then anomalies of an Angle Class I type will develop (Figs. 12 and 13), and in cases of extreme disrelation extraction will have to take place. Extractions in this type will generally concern both jaws symmetrically, since here the jaws are really small, i.e., of a harmoniously diminished size, whereas in leptosomic jaws the smallness is due to narrowness to which, in the mandible, may still be added shortness. This results in varying degrees of smallness in the maxilla and mandible and leads to individually different ways in treatment, extractions being indicated in the maxilla or in the mandible, or in both. After some training we shall detect that extractions in the maxilla will be the rule in relatively pure leptosomic types whereas other indications will reveal that the type is blended with hypoplastic features (Fig. 10).

These blended types—Kretschmer has termed them alloys—represent, of course, a very difficult matter which has not yet been completely cleared by constitutionalists. But since, I hope, the foregoing pages have shown that many of our problems may become easier under constitutional aspects, we shall not shrink from the fact that constitutionalism itself has not yet solved all its problems. Perhaps orthodontic investigations may prove to be helpful to constitutional research, too, and both branches of science will progress together.

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OSTEOMYELITIS OF THE JAWS

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A FACT that is often overlooked is that osteomyelitis will affect the jaws in many instances wherein teeth have not been removed. The surprising thing to me is that osteomyelitis of the jaw does not more often follow the removal of teeth.

As everyone knows, the mouth is continually bathed in a flora of bacteria, some of which become pathogenic once they invade tissues that furnish an anaerobic environment. Most types of osteomyelitis are of a mixed infection with the staphylococcus predominating. However, we can have osteomyelitis of a specific infection, but this is rare.

The clinician of wider experience is impressed by the fact that osteomyelitis most often follows traumatic injury to the jaw, wherein the patient has that vague, physical index known as a "low resistance." Patients whose physical tone has been lowered by diseases such as diabetes, tuberculosis, anemia, or other blood dyscrasias are potential risks when any form of surgery of the mouth is indicated. In such cases, osteomyelitis is often a postoperative sequela. Particularly is this true if excessive trauma during the operative procedures is not avoided and if careful and frequent postoperative observations are not made.

The writer feels that the resistance of the patient, plus the virulence of the organism, plus the traumatic injury and environment are often factors in the development of osteomyelitis of the jaw. Wherever congestion of the soft tissues of the mouth develops, and whenever the congestion is not relieved, osteomyelitis often follows; especially is this true when the congestion is in contact with bone for a long time. Whenever pus in the soft tissues has been allowed to remain in contact with bone for a long time without drainage, we often see osteomyelitis developing. A conservative form of treatment is the best method indicated in most cases. However, this does not mean a "do nothing" policy entirely. One must watch the case carefully for signs and symptoms of pus. Adequate and positive drainage must be established, once one is sure that pus is present. Complete aeration of the tissues should be given consideration in any type of incision that is made. Within the mouth it is often best to cut tissue away so as to create a gaping wound in order to insure proper drainage and free ingress of air.

From the Clinics of Doctors Mead, Newton, Lynch and Dingman.

External incisions should be large enough to permit the proper drains to be inserted. Drains should be allowed to remain in position long enough to accomplish their purpose. They should be of a type that will not clog or become compressed so that drainage is prevented. There can be no set rules for treatment, but each case must be handled individually, based upon the experiences of the surgeon and upon the changing signs and symptoms of the patient. Although some men have advocated radical curettement of bone, the writer feels that a "safe and sane" policy of drainage and then a watchful-waiting period, with particular thought to the up-building of a good physical tone in the patient until such a time as sequestra form, are often the best mode of treatment. Sequestrum does not always form, but when it does, one should wait until it is completely exfoliated before attempting removal. There may be one sequestrum or more. Usually after all sequestra have been removed, the soft tissue wounds heal very rapidly.

Osteomyelitis of the jaws seems to have two stages of development. The first is the acute stage which is characterized by severe pain and swelling. In the early days of the disease, no roentgenographic evidence of the disease is visible. However, after about ten days the x-ray plates will usually begin to show a mottled or wormy appearance of the bone. By this time, drainage has usually been established, the pain has subsided, and the diagnosis is definite. The disease now enters its chronic stage which may last for several days, or for weeks, until the sequestra have been formed. During the chronic stage it is possible for the drainage to "pocket off," and secondary acute processes develop which must be relieved by drainage either by new incisions or through the old incisions. Special attention should be given to the patient's physical condition, and it is well to cooperate with the patient's family physician with a view toward developing a high index of physical resistance. Rest in bed, a well-balanced diet rich in vitamins, calcium and phosphorus and other minerals, are often helpful. Blood transfusions are often beneficial, but especially so in those cases which develop secondary anemia. Sunshine and mental preoccupation are helpful in the long drawn out cases. In osteomyelitis of the jaws the process can be a simple one, confined solely to one tooth socket, or it may extend and involve the whole jaw. Oftentimes, the teeth become loose during the progress of the disease, and it is a fine point of diagnosis to determine whether or not to remove them. I have the feeling that where the teeth are loose enough to be an irritating factor, they should be sacrificed. However, if their removal will not aid in the treatment of the condition, their retention is indicated. Because the mandible is a movable part, osteomyelitis of this bone is particularly difficult to treat, and often immobilization is helpful. When the osteomyelitis processes involve the head of the condyle, the possibility of postoperative ankylosis is imminent, and is often a source of great worry to the patient and the surgeon. Brown feels that where the head of the condyle is involved, we never get complete regeneration. With this thought in mind the following case report is of interest, first because we had a complete loss of structure involving the head of the condyle, and secondly because the patient at the present time has complete function and thorough use of his jaws. Repeated attempts to get roentgenographic evidence of the regeneration of the head of the condyle have not been

completely successful, but what evidence we do see is certainly encouraging and gives one the feeling that we may be able to demonstrate a new bony replacement of the condyle. Although the entire ramus was lost, a new ramus has been developed with all the anatomic landmarks in the roentgenographic plate, and therefore we believe that the head of the condyle might be developed also. In this particular case, it is interesting to note that a conservative type of treatment was followed, and that after the loss of structure, the jaws were wired into position so as to retain the normal relationship of the teeth. This allowed the periosteum to be stretched and thereby form a framework by which new bone could be built. This would seem to indicate that it would be well to make an effort in all cases in which deformity results, to attempt some form of treatment with a view toward retaining or establishing normal anatomic relationships of the teeth and jaws.

This case is presented with no new ideas regarding treatment or any new prophecies regarding results. Wherever it has been presented, it has created considerable interest and discussion and is published at this time with the hope that it will be of some help and encouragement to those men who are troubled with the same problems.

REPORT OF CASE

Case History.—Mr. W. T., aged 28 years, was first seen April 18, 1933. He had a cervical cellulitis involving the left side of the face and neck. His temperature was 103° F. He was suffering severe pain and appeared extremely toxic. He had a left mandibular third molar removed ten days previous under a local anesthetic. The patient said that at the time the tooth was removed, it was sore. The tooth was cleanly removed and the patient suffered no unusual discomfort. The next day his face began to swell, and he returned to the dentist for treatment. The patient said that the wound was irrigated daily and a dressing inserted. His face continued to swell. On the seventh day he went to see his physician, but his physician suggested that he go back to his dentist for treatment. The patient returned to his dentist. On the tenth day the patient was suffering such severe pain that his employer referred him to our oral surgical service.

Examination.—Clinical examination revealed a hard edematous phlegmon that did not pit upon pressure. Intraoral examination showed pus to be present under the masseter muscle.

Operation.—The patient was sent to the hospital and was operated upon the same day. An intraoral incision was made along the anterior border of the ramus, and a large quantity of pus drained from the angle of the jaw. The patient received much relief from pain following the incision. The next day the swelling had spread posteriorly to the mastoid region and anteriorly to the median line of the neck, extending from the clavicle to a point above the ear. The ear was distended and swollen. The patient was not suffering pain but looked considerably worse. After consultation it was decided that regardless of the lack of "pointing" free external incision and drainage should be done immediately. Very little pus was discovered and what little was found was quite deep. Two drainage tubes were inserted, one extending from below the lower border of the mandible up along the external surface of the ramus to a point

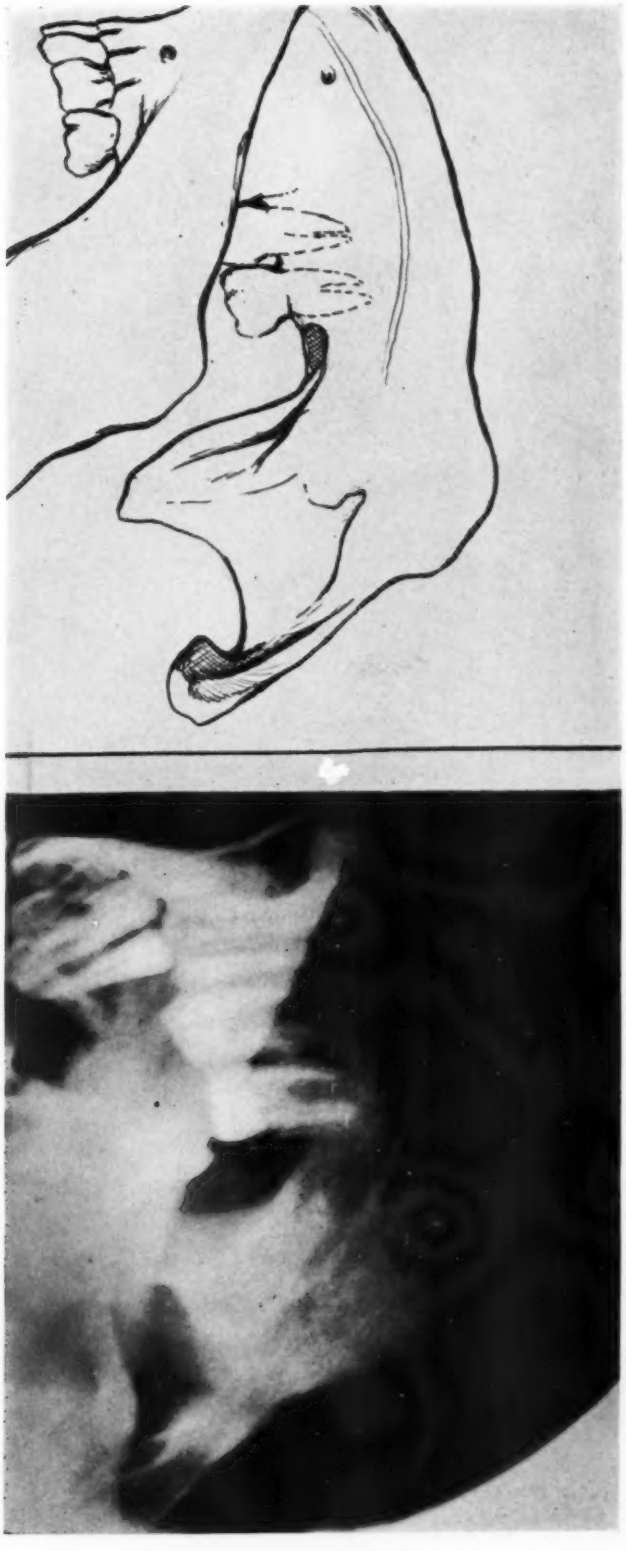


Fig. 1.—April 18, 1933, roentgenographic appearance of the mandible ten days after extraction. No osteomyelitis is evident. Note the clinical appearance was a definite cellulitis.

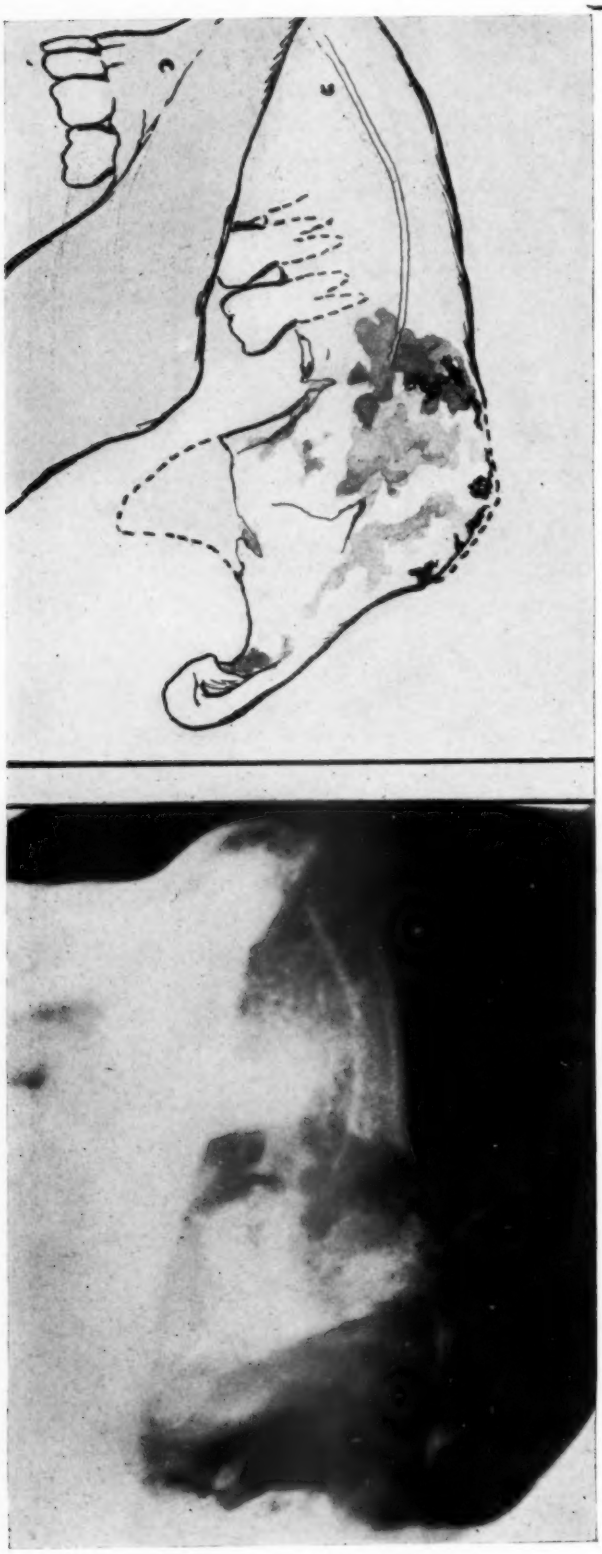


Fig. 2.—May 27, 1933, roentgenographic appearance of the mandible, diffused osteomyelitis of the ramus and mandible. The dotted lines indicate destroyed bone; shaded areas indicate progress of osteomyelitic process.

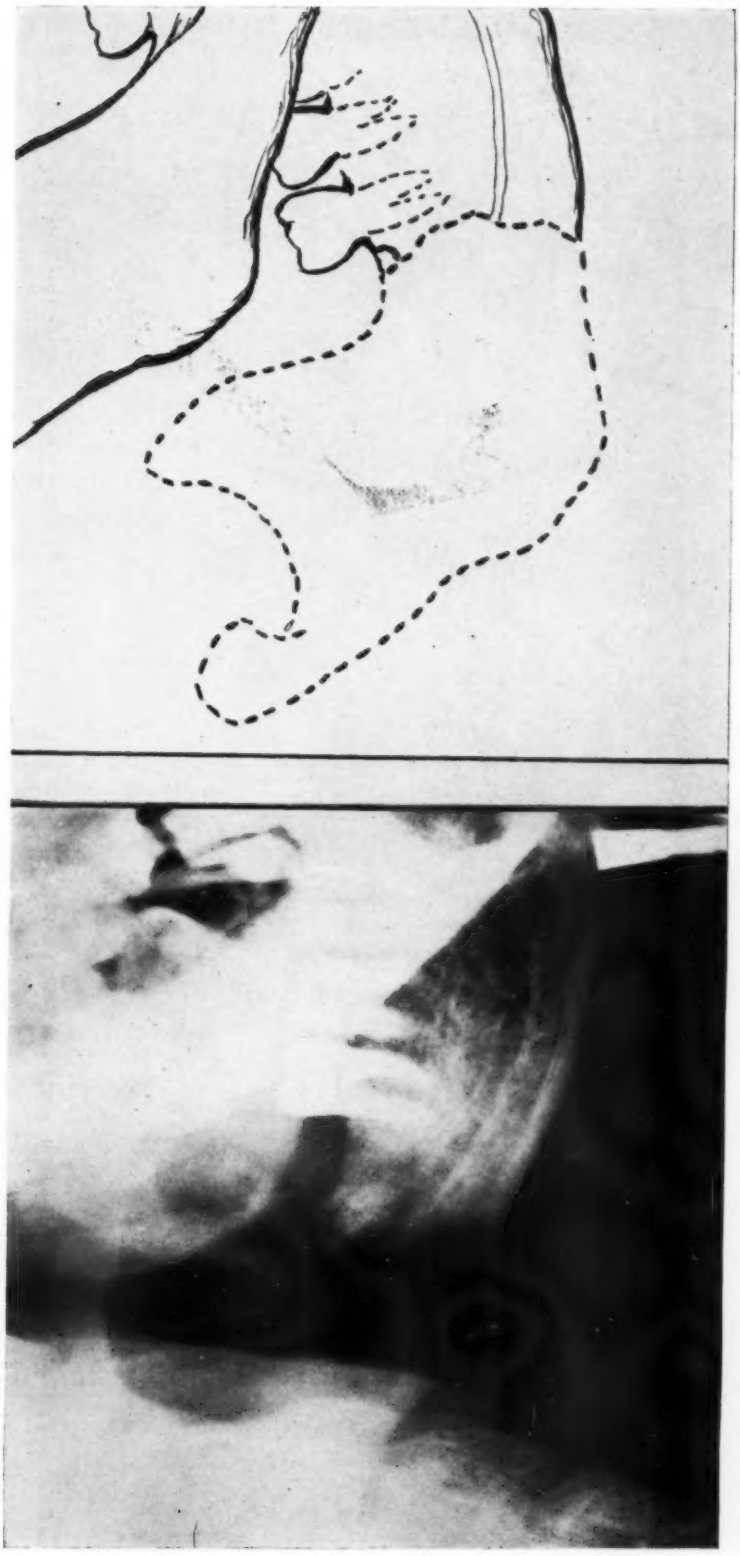


Fig. 3.—July 6, 1933, roentgenographic appearance of the mandible, left ramus completely removed. The dotted lines indicate the missing portion of bone.

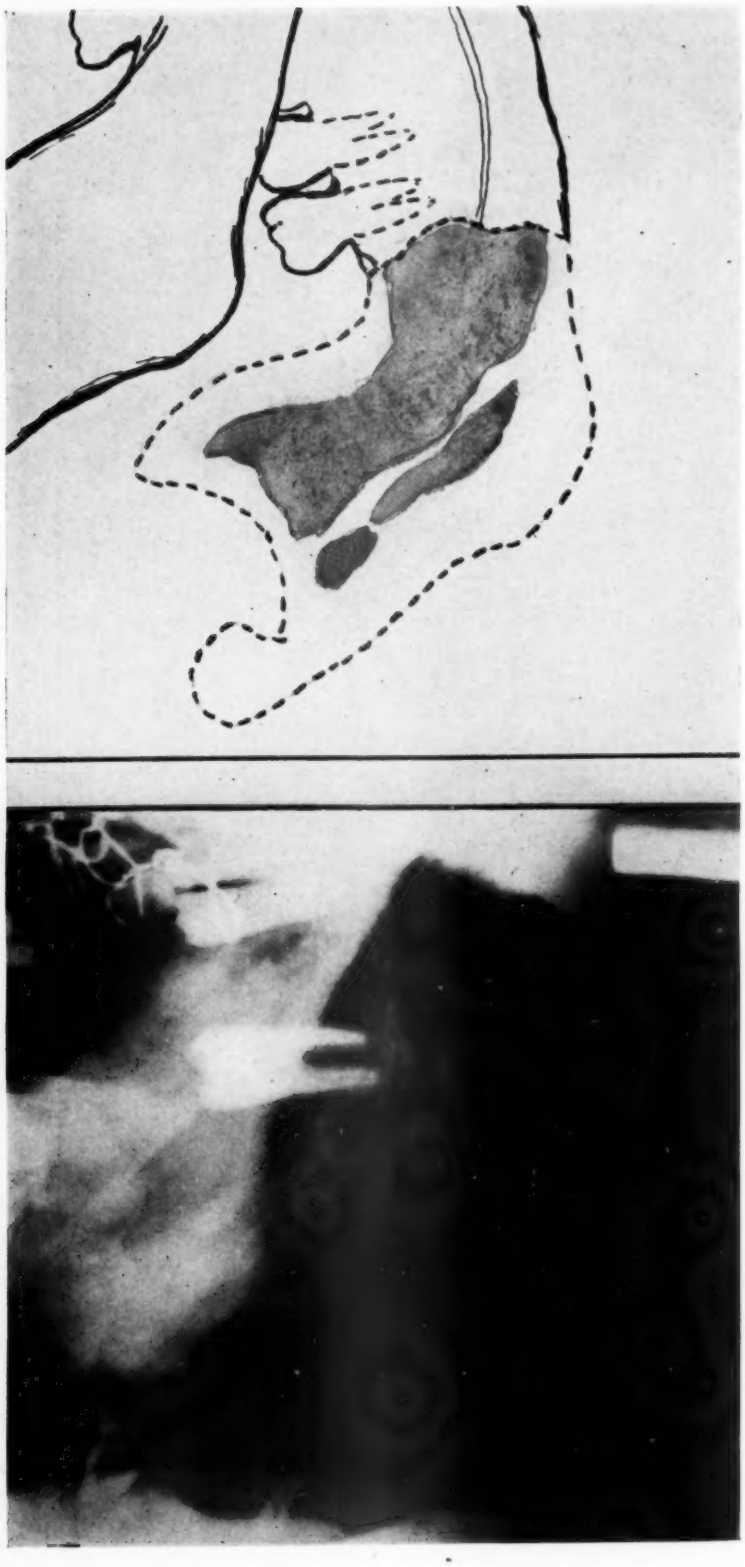


Fig. 4.—Sept. 26, 1933, roentgenographic appearance of new bone formation. The dotted lines indicate the original outline of the ramus; the shaded areas indicate growth of new bone.

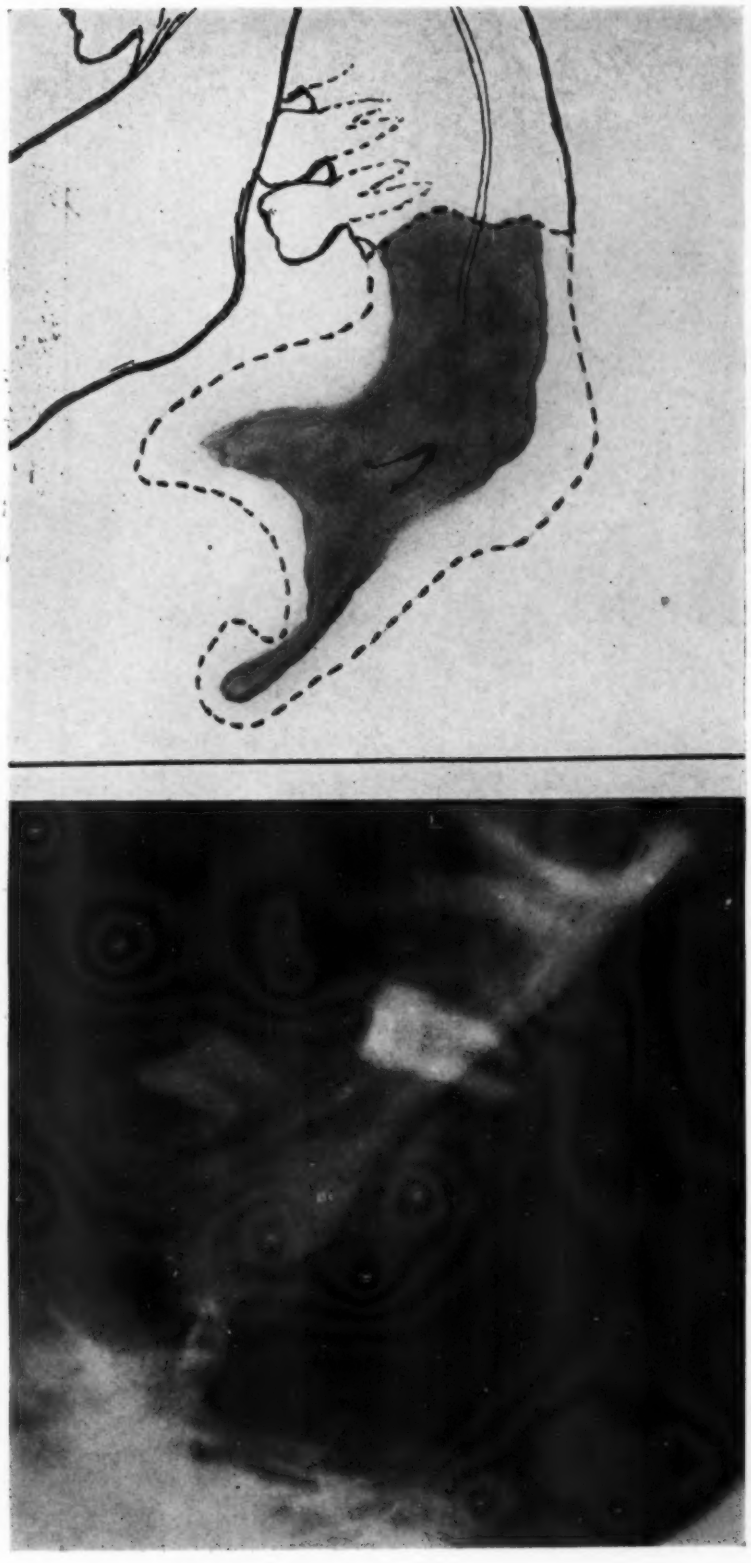


Fig. 5.—Dec. 15, 1933, roentgenographic appearance of new bone formation. The dotted lines indicate the original outline of the ramus; the shaded area indicates continued growth of bone.

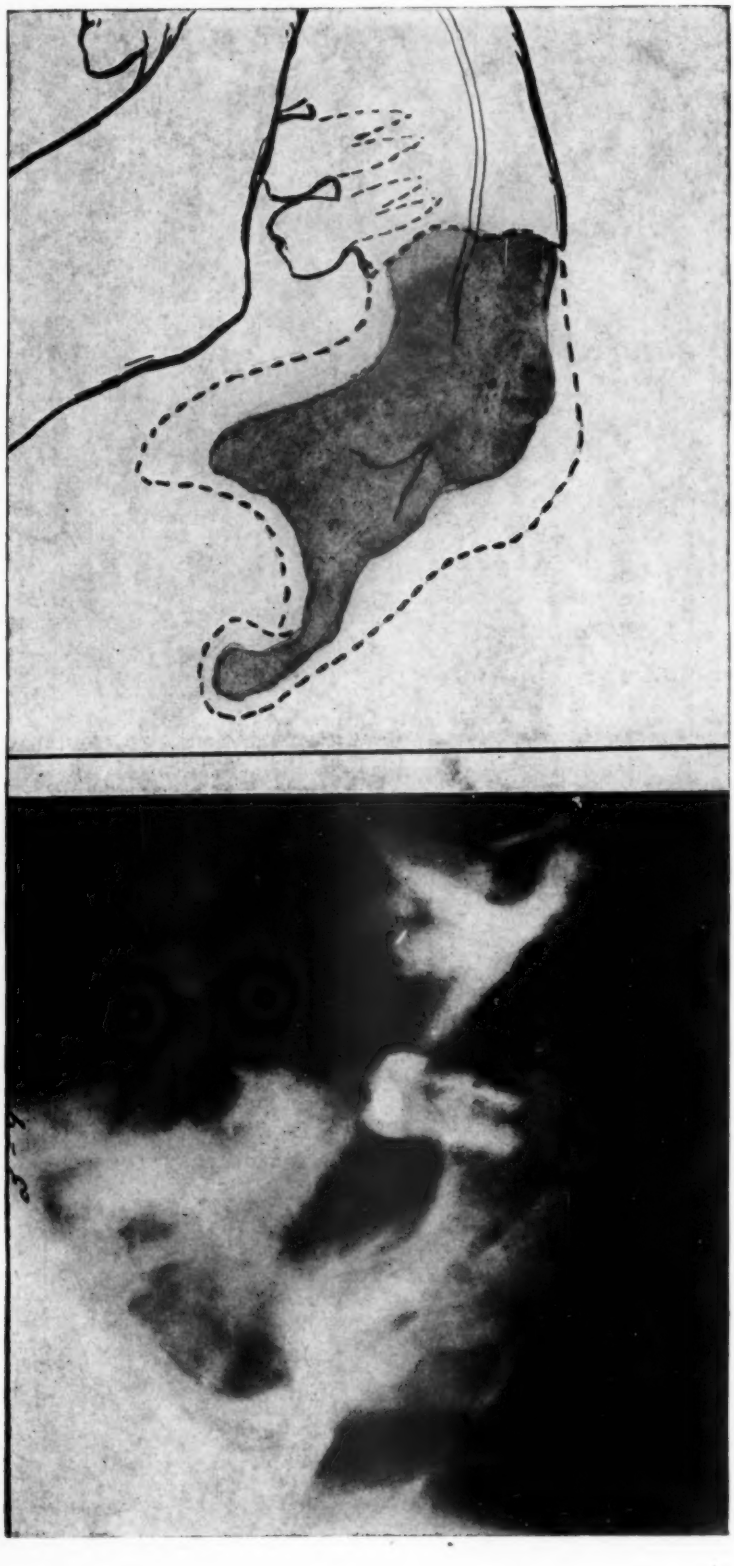


Fig. 6.—March 9, 1934, roentgenographic appearance of new bone formation. The dotted lines indicate the original outline of the ramus; the shaded area, the continued growth of bone.

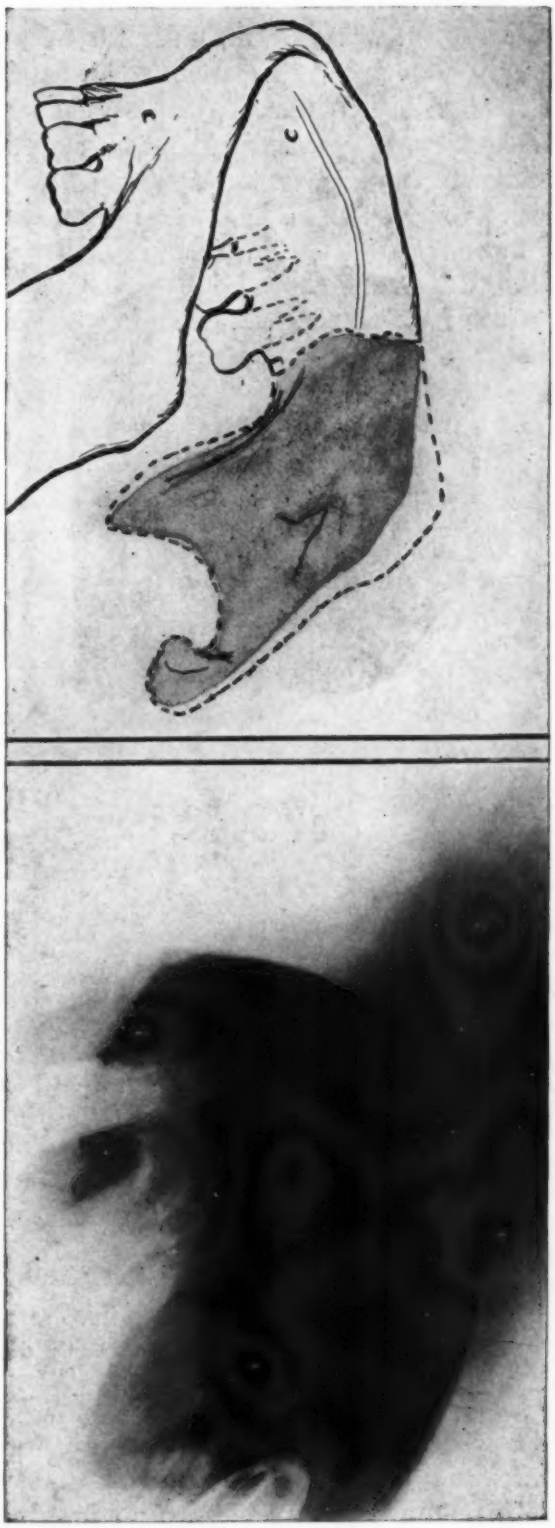
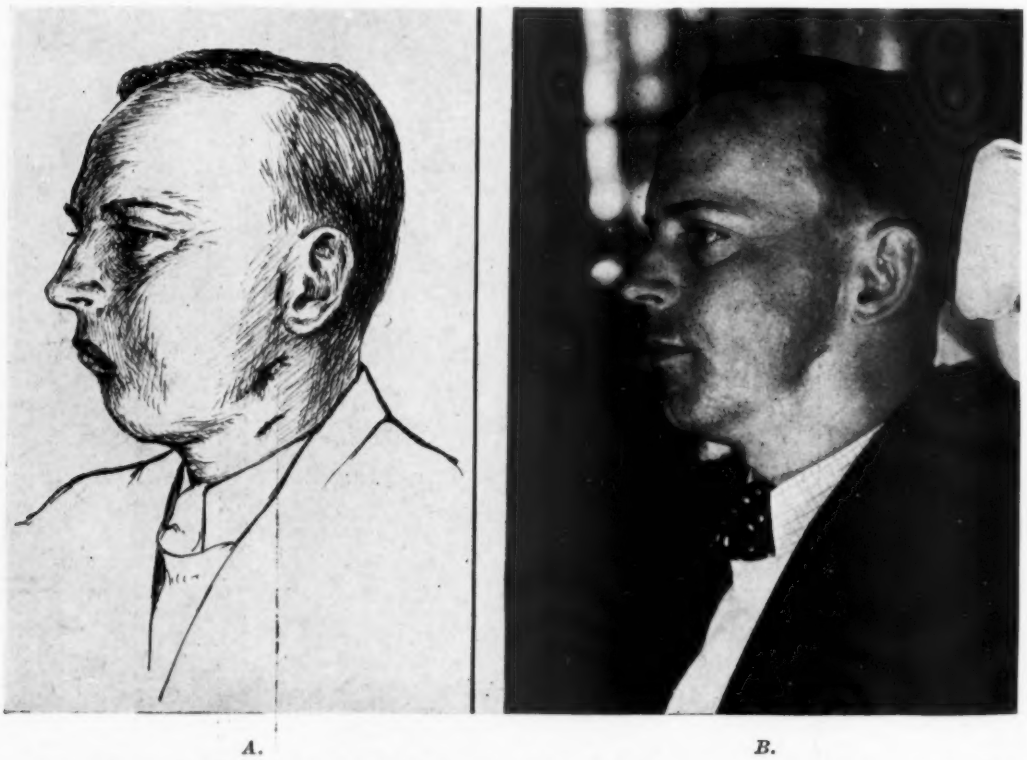


Fig. 7.—June 23, 1936, roentgenographic appearance of new bone formation. The dotted lines indicate the original outline of the ramus. The shaded area indicates the continued growth of bone. Note the original outline of the ramus is almost completely reproduced.

in front of the ear just below the malar process; the other extended from the external posterior angle of the jaw to the inside of the mouth. The patient's temperature before the operation was 105° F., pulse 120, respiration 23. The wound continued to drain profusely, but the patient recovered rapidly. He was discharged from the hospital on April 20, 1933, with both tubes in position and the wound draining freely. He was seen daily and on May 3, 1933, the first roentgenographic evidence of osteomyelitis was apparent. Because the wound began to pocket off below our first incision, it was decided on May 26 that another operation was indicated. A new incision was made lower in the neck and the old incisions extended. Small pieces of sequestra were removed as well as a large sequestrum involving the entire ramus and condyle. An attempt to wire the jaws was made but proved to be unsatisfactory. Drainage from the wound ceased two days after operation. The patient made an uneventful recovery and was discharged from the hospital the second day of July in very good physical condition but with a marked deformity of the face and mandible. There was no occlusion of the mandibular teeth to the maxillary teeth and the midline of the mandible was swung considerably to the left and drawn back.



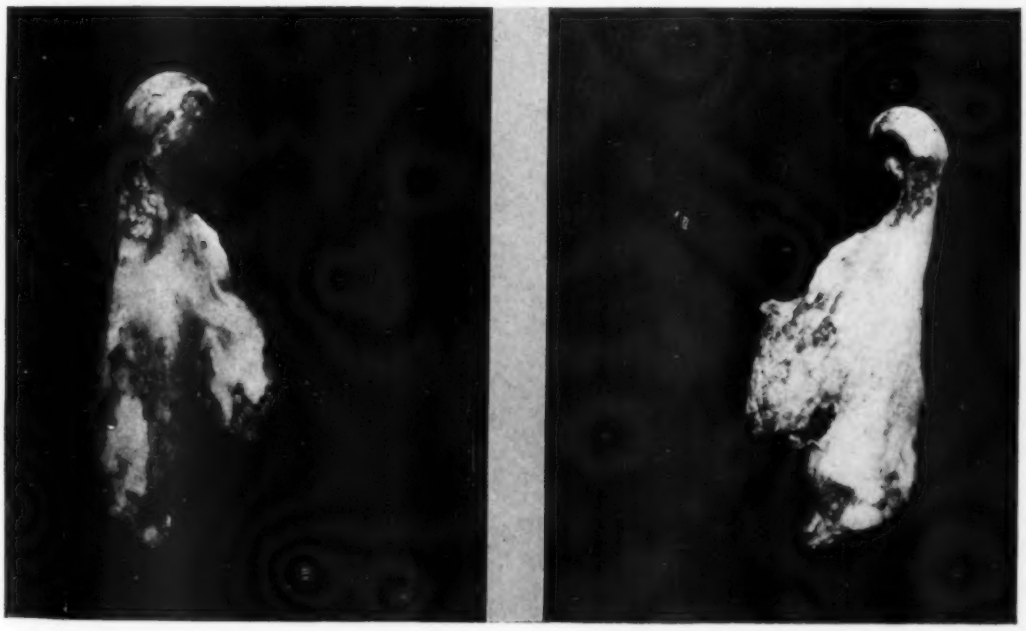
A. *B.*

Fig. 8.—*A*, An artist's sketch of the patient, July 6, 1933. Note the sagging mandible and postoperative scars. *B*, Photograph of the patient, March 9, 1934. Note the normal relationship of the lips and the gradual disappearance of the scars.

July 24, interdental wires were placed about the teeth and with gradual traction the mandible was swung into normal occlusion with the maxilla and fixed into permanent position with intermaxillary wires. In other words, the jaw was wired into position in the same manner as we would handle a fractured jaw. Aug. 24, the intermaxillary wires were removed and some of the teeth were

A. *B.*

Fig. 9.—*A*, An artist's sketch of the patient, July 6, 1933. Note the displacement of the mandible, inward and backward, due to the removal of the left ramus. *B*, Photograph of the patient, March 9, 1934. Note the almost symmetrical appearance of the face. No displacement of the mandible is evident.



A. *B.*

Fig. 10.—*A*, Internal view of the sequestrated ramus. *B*, External view of the sequestrated ramus

ground to permit better occlusion. Sept. 20, the jaws were again wired into a fixed position. Nov. 17, 1933, all wires were removed and the patient was instructed in the care of his mouth with particular reference to the pull of his muscles so that normal occlusion would be established. Periodically, the teeth have been ground to permit better occlusion. Today, there is no deformity and the occlusion of the teeth is perfect. Physiologic function has been restored.

Your attention is called particularly to the large amount of bone which was lost at the time of operation. Nature has apparently developed a new ramus with all the original anatomical characteristics, such as the angle, the mandibular canal, a sigmoid notch, and a mandibular sulcus.

Osteomyelitis of the mandible, with involvement of the entire ramus followed by complete sequestration of the ramus, is not unusual. However, when the exfoliated bone is completely replaced by new bone so that all anatomic landmarks are more or less adequately restored and normal function is achieved, then such a case is worthy of study and consideration.

DISTOCLUSION WITH PROTRACTION OF THE MAXILLARY INCISORS

FERNANDO MARTINEZ DE APARICIO, D.D.S., CAIBARIEN, CUBA

MRS. E. L., aged 36 years, living in the city of Caibarien, came to my office in September, 1938, to receive orthodontic treatment (Fig. 1 *A*). As we can see in Fig. 2 *A*, this is, considering the general terms, a remarkable case of distoclusion with protraction of the maxillary incisors.

The patient stated that at previous times she had attempted to have this abnormality corrected. Since she was a child, the anomaly could be seen, but she had always been told "that" could not be healed. I informed her that at this time the case could not be treated by orthodontic means, but that if she wished, we could employ surgical means, inserting the prosthetic dentures later.

Fig. 1.

The operation was postponed until the beginning of 1939. On Jan. 6 she came to my office again, ready to put her case in my hands, manifesting that she could not live longer under such mental suffering.

Under these conditions several photographs as well as impressions and bites were made by the gnathostatic process. In Figs. 1 *A* and *B* one can appreciate the deformity as the teeth are seen in a normal occlusal position in which the maxillary incisors and canines cannot be covered by the lip.

Also in Figs. 1 *C*, 2 *A*, and 3 *A* we note the occlusion of the mandibular incisors at the palatal at a distance of 1 cm. from the neck of the incisors and corresponding to the orbital plane (Fig. 3 *A*, line *c-d*, orbital plane).

I asked the patient to return the next day and, in the meantime, studied the photographs and casts. I was able to determine, shown with dotted lines in casts Figs. 2 *A* and 3 *A*, the extent of alveolotomy to be undertaken. The hardest problem was that the alveolotomy might be followed by resorption of the alveolar process, and that, instead of an apparent distoclusion, a dwarfing of the maxilla might result. The patient would then have an anomaly, although a different one than she had before the operation.

In general terms, following mainly the classification of Dr. McCoy, we may say that, regarding the median or sagittal plane, there was symmetry of both arches. Regarding the orbital plane, there was protraction of the maxillary incisors and the corresponding alveolar process in high degree, and extreme mandibular retraction. In the Frankfort plane there was an incisor-alveolar maxillary abstraction and a total mandibular attraction.

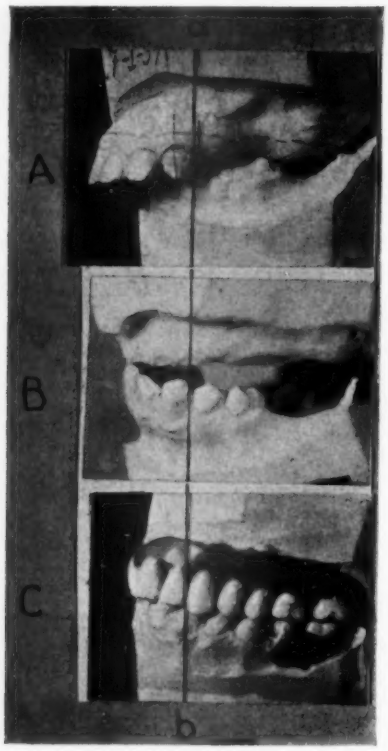


Fig. 2.

On Jan. 7, as previously planned, I performed the operation. The patient appeared happy and hopeful. I used a drop and spray with chlorazene Abbott solution as an antiseptic and the following instruments: syringe, forceps, curved scissors, bone-cutting forceps, periosteum separator, No. 2 needle, and horse hair. I administered the anesthetic, "Carpule" 4 per cent, by infiltration injection.

The operation was divided into three parts. The first injection of anesthesia included the section from the maxillary tuberosity to the first premolar.

The teeth and roots were extracted; the mucoperiosteum was separated, alveolotomy was performed, and the surplus gum tissue was trimmed and sutured.

The second injection included the section from the left maxillary canine to the right maxillary canine. The same procedure was followed as before, and the gums were sutured at two points.

The third injection extended from the right canine region to that of the second maxillary molar, and the same procedure was followed again.

The operation lasted one hour and ten minutes, and the patient remained quiet and showed no signs of pain.

Fig. 1 *D* shows the patient's gums when the operation was completed. Fig. 1 *E* was taken four days later, after the suture points were removed. Figs. 1 *F* and 3 *B* were taken four months after the operation, when the patient got the corresponding prosthetic dentures.

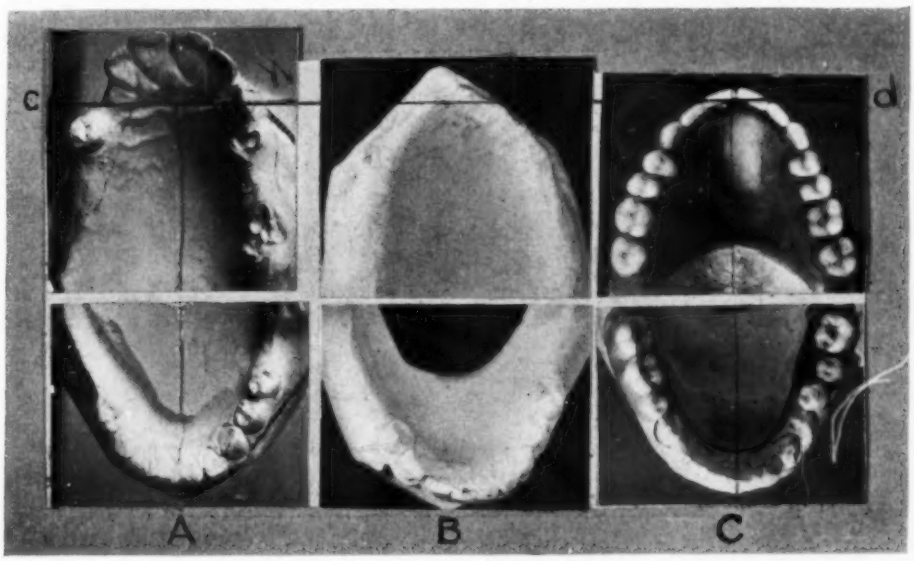


Fig. 3.

In Figs. 2 *A*, *B*, and *C* one can see, posterior to the line *a-b* (orbital plane), the casts before the operation, four months after it, and finally the prosthetic dentures as they remain definitely.

In Figs. 3 *A*, *B*, and *C*, where the line *c-d* corresponds also to the orbital or canine plane, one can see the surplus portion, the extent of the operation, and the dentures in position.

Figs. 1 *G*, *H*, and *I* show the patient with the prosthetic appliances in place for the first time. The results of the operation are evident if one compares Fig. 1 *G* with 1 *A*, Fig. 1 *H* with 1 *B*, and Fig. 1 *I* with 1 *C*. The patient feels the operation was accomplished with entire success.

POSITIONING FOR CORRECT ANGLIZATION IN RADIOGRAMS

J. Holden Beckwith, D.D.S., Miami, Fla.

FOR correct anglization in radiograms of the temporomandibular joints and third molars, the following methods are suggested with illustrations.

Adjust the back and headrest of the chair so that the frame over the casette is parallel with the floor. Have the patient turn in the chair, placing one arm around the back of the chair and with the other hand hold the casette in place, as shown in Figs. 4 and 5. *For temporomandibular joint exposure* the patient's ear is placed in the circle and the head is moved back until the ear is against the

Fig. 1.—Regular casette for 5 by 7 inch film.

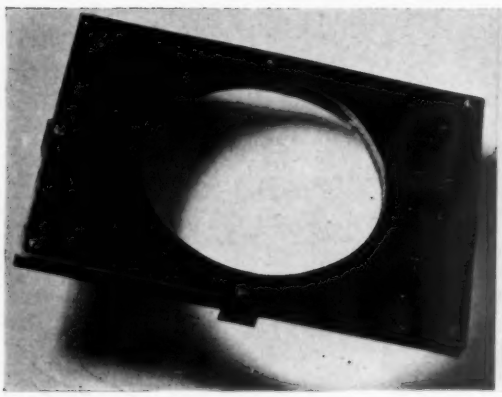


Fig. 2.

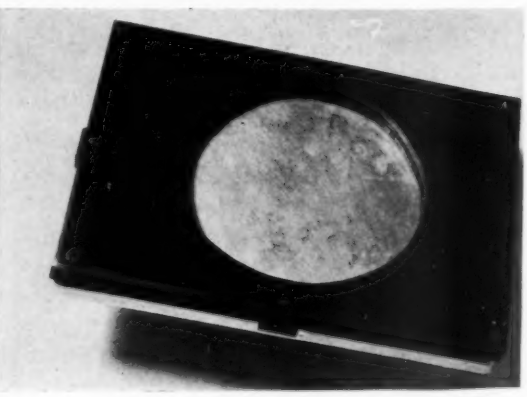


Fig. 3.

Fig. 2.—Casette frame with side lugs for firm attachment over casette. The frame is made of two thin pieces of wood with a lead sheet between and is held together with screws. Diameter of the circle is four and one-fourth inches and depth one-half inch. After several measurements for thickness this was the most desirable.

Fig. 3.—Casette frame placed over casette.

circle edge. Distance is measured from the auditory meatus to the orbital process of the malar bone. From this last point measure back two-thirds of the distance. At this point measure up one inch and place the cone on the face.

For third molar area exposure the chin is placed in the circle, and the head is turned until the nose is in contact with the casette. Raise the cone four inches from under the condyle and make the exposure.

Fig. 4.

Fig. 5.

Fig. 4.—Patient in proper position for temporomandibular joint exposure.
Fig. 5.—Patient in proper position for third molar exposure.

Case Reports

Dr. James G. Morgan has supplied a very interesting case report with x-rays and a piece of excised tumor for further investigation by the Department of Oral Pathology of Harvard University.

Case reports for this section of the Journal should be sent to Dr. Kurt H. Thoma, 53 Bay State Road, Boston, Mass.

CASE REPORT NO. 39

MANDIBULAR MIXED TUMOR OF THE SALIVARY TYPE

JAMES G. MORGAN, D.D.S., SCRANTON, PA., AND KURT H. THOMA, D.M.D., BOSTON, MASS.

CASE 39, a male, 52 years of age and of Greek descent, presented himself at the Moses Taylor Hospital on Feb. 8, 1940, with a large tumor occupying practically the entire half of the left side of the mouth.

From the patient's previous history it was learned that in April, 1939, he had had a mandibular left second premolar removed. At that time a small tumor was noted surrounding the tooth and emanating from the peridental membrane or epithelium of the mucosa. He was instructed to have the tumor cared for, but inasmuch as he had no pain, nothing was done until he came in Feb. 8, 1940. At this time the mass had grown so large that he could not close his jaws without having the maxillary teeth bite into the tumor, but still he had no pain.

Clinically, the tumor was the size of a baseball, was semisolid in texture, and extended anteriorly from the mandibular left incisor region and posteriorly to the middle of the ramus of the left mandible; lingually to the midline of the floor of the mouth and buccally very extensively into the cheek. It appeared to be the same in color as the mucous membrane of the mouth, which was normal, and its origin seemed to be in the region of the removed tooth.

X-ray examination showed extensive destruction of the body of the mandible on the left side, with irregular calcium deposit in the regional tissue (Fig. 1). This defect was filled in by soft tissue shadow, projecting inward and outward, and partially limited by a thin calcium shell. The diagnosis from the x-ray was: "Malignant tumor of the soft tissues, destroying the mandible."

The laboratory data showed the following: Blood Examination—hemoglobin, 89 per cent; red blood cells, 4,740,000; white blood cells, 5,500; small lymphocytes, 25; large lymphocytes, 8; transitionals, 1; polymorphonuclears, 66. The Wassermann reaction was negative. Urine Examination showed: Reaction, acid; sugar, negative; albumin, bile, diacetic acid, and sediment, all within normal limits.

A biopsy was done on Feb. 22, 1940, and the report was as follows: "Section has a shiny, pearly appearance, is covered with a thick layer of epithelium,

and cuts with resistance. Diagnosis—Fibroma or Neurofibroma.'' Microscopic examination of the section showed the central portion to be composed of very dense collagenous tissue. In one area, there was a very thin squamous epithelial covering. This was followed by an area of ulceration and infiltration of plasma cells and polymorphonuclear cells. Still further along the border, a thick layer of basal cells could be seen, penetrating areas rather deeply. The section did not have the squamous type of cell nor the hyaline formation as seen in typical

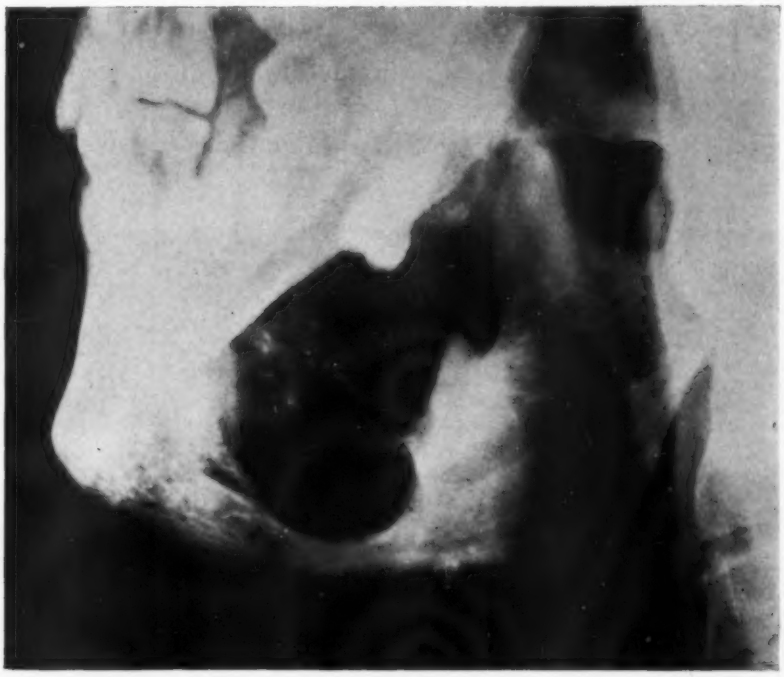


Fig. 1.—Roentgen picture of the mandible, showing osteolysis due to malignant mixed tumor of the salivary type. Note the calcified tissue within the tumor.

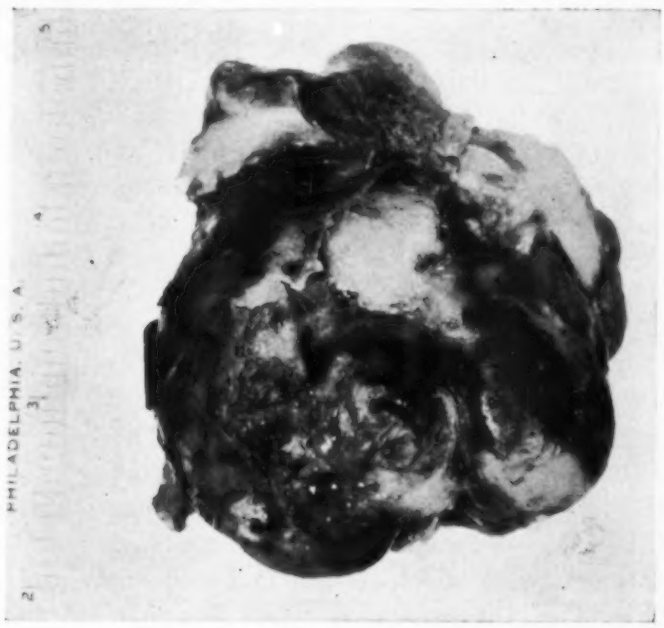


Fig. 2.—Excised tumor mass.

adamantinomas. For this reason, the diagnosis of basal-cell epithelioma superimposed on a fibroma was made. The diagnosis was: "Fibroma presenting a superimposed basal-cell epithelioma."

Operation was performed on Feb. 23, 1940, under ether anesthetic, the patient having been given a transfusion the day before. An elliptical incision was made around the base of the tumor through the mucous membrane. On the floor of the mouth two displaced teeth were removed and several others in the anterior region of the mandible; namely, the incisors, canine, and first premolar. The growth was enucleated from the jaw bone cavity (Fig. 2). Interrupted sutures brought the mucous membrane in the region of the tonsil over the mandible and the resulting cavity was packed with gauze.

The specimen was sent to be photographed and biopsy sent to the pathology laboratory.

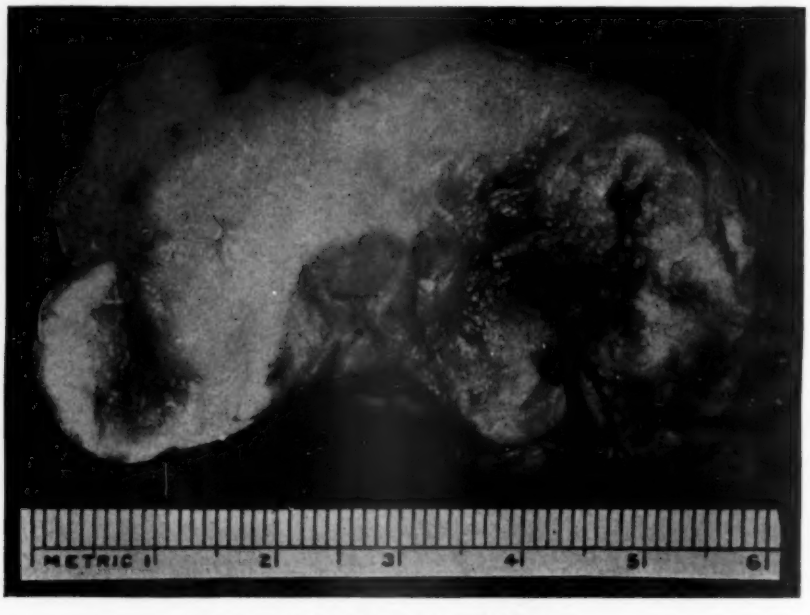


Fig. 3.—Section through excised tumor.

Following the operation the temperature, pulse, and respiration returned to normal within a few days. The packing was changed daily and the area irrigated regularly with an antiseptic mouth solution until February 26, when there appeared a slight sloughing of the mandible in the region of the angle. Then zinc peroxide as a mouthwash was used every three hours until the patient was discharged from the hospital on March 4, 1940. He was then referred to the outpatient service and treated there semiweekly, returning to work on March 21, 1940.

Pathologic Examination (Department of Oral Pathology, Harvard Dental School).—A section of the tumor was received, measuring 3½ by 6 by 1 cm. A photograph (Fig. 3) showed that it was composed of a light appearing tissue which contained some darker areas. Microscopic sections revealed the tumor to consist of connective tissue which seemed to predominate and strands of epithelial cells (Fig. 4). The connective tissue was in some areas of mucinous

character, fairly rich in fibroblasts, with areas in which there appeared numerous bone trabeculae (Fig. 5). The epithelium was arranged in cords with small cystlike formations and showed mitotic figures, which denote its malignant character. Diagnosis: Malignant mixed tumor of the salivary type.

Dr. Charles F. Geschickter, to whom the tumor was submitted for an opinion, agreed with the diagnosis of aberrant mixed tumor of the salivary type. He stated that he would grade it among the carcinomas rather than as a benign tumor. His classification of salivary tumors consists of benign mixed tumor and malignant basal-cell carcinoma; he would place this growth in the latter group.

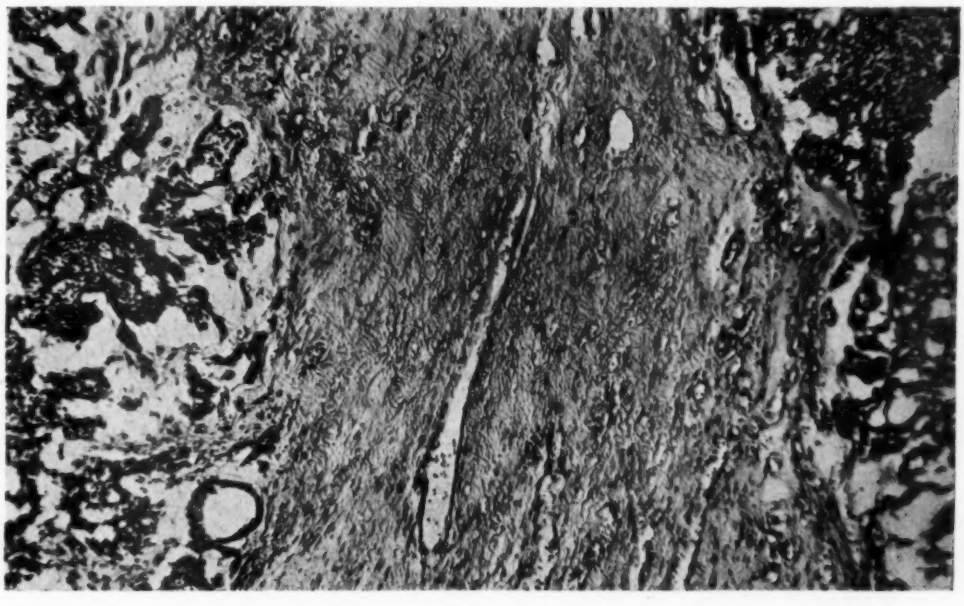


Fig. 4.—Photomicrograph showing connective tissue and epithelial components of tumor.

Fig. 5.—Photomicrograph showing bone trabeculae in the connective tissue portion of the tumor.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City.

The Mechanical and Histologic Problems in the Rotation of Teeth: By Kaare Reitan, Norway, *Den Norske Tannl. Tid.* **50**: 1 (Jan.), 1940.

The author carried out a series of experiments on dogs at the Northwestern University Dental School in 1938-39 on the changes taking place in the supporting tissues of the teeth during rotation. Five healthy, adult dogs were used for the experiments, and in all ten teeth were rotated. Fixed appliances were used, especially constructed for this purpose, and allowing both an intermittent and a continuous force to be applied. The author, however, maintains, in agreement with other investigators (Orban, Andresen), that from a histologic point of view there does not exist any real intermittent orthodontic force, while such is possible from a mechanical standpoint.

The right and left lateral incisors of the maxilla were used for rotation. These teeth were banded and small staples soldered on the lingual and labial sides of these bands. The canines were used as anchor teeth.

Three types of appliances were used. Great care was taken to avoid any injury of the soft tissues and interference with the teeth of the mandible during mastication. For this reason the mandibular incisors were ground off repeatedly, an interdental space being created in this way. The force applied was measured by means of a special apparatus, and varied in the different cases from 9 to 250 Gm. The time used for the rotation varied from three to fifty-nine days. The author further deals with the mechanical factors present during tooth movement and demonstrates that the degree of force may be increased considerably, due to the form and position of the tooth, and that the rotation may be hindered for the same reason.

Histologically a distinction is drawn between the tissue reactions called forth by a continuous force (steel appliances in which springs of a thickness of .020 to .030 mm. are used) and that produced by a, mechanically speaking, intermittent force. When applying the continuous force mentioned, there is less jiggling, the tooth being quite firm during rotation, but at the same time moving faster even if a relatively weak force be applied, due to the fact that the springs are activated over a longer distance and because of the great resilience of these springs.

By using appliances exerting a continuous force, resorption of the root will to some degree take place on the pressure or relaxation side of the root, especially on account of the oval root form, seen in horizontal cross section,

but no resorption of the surface of the root will occur as long as this is moved parallel to the bone wall of the alveolus. The peridental fibers, which are supposed to undergo interstitial growth in these cases, will become severely stretched and more or less arranged in the direction of the movement of the tooth, running diagonally from the alveolar wall to the surface of the root. The capillaries are found more or less compressed and, together with fibroblasts, arranged parallel to the peridental fibers. At the same time new osteoid tissue is formed in the tension areas in form of tongue-like trabeculae, often followed by a compensatory resorption of the outer bone wall of the labial side. This new bone proved to be transformed and rounded off to form a new *lamina dura* during the period of retention. Layers of cellular cement were formed on the tension surface of the roots, especially in the middle and apical portions.

By applying a, mechanically speaking, intermittent force, the peridental fibers exposed to a similar stretching, while the alveolus as a whole is considerably widened, particularly on its labial side. The difference is ascribed to the appliances used as well as to the form of the crown of the tooth and to other mechanical factors.

When applying a continuous force, it seems that the subepithelial tissue is not subjected to a similar rapid transformation, and that an elastic contraction of this relatively loose connective tissue may take place during the period of retention, thereby possibly being one of the principal causes of relapse after rotation. The peridental fibers in the apical region of the root will not be exposed to a similar heavy stretch, as—according to the laws of mechanics—the degree of rotation is dependent on the length of the diameter of the root.

Considering the rather different anatomical conditions found in man and in the dog, the result of the experiments presented may be summed up as follows:

1. There are always certain mechanical problems connected with rotation of teeth of great importance to the application of the orthodontic force.

2. The form of the tooth must be taken into consideration with such tooth movement. It seems possible that a tooth, the root of which in cross-section more nearly approximates the arc of a circle, could be rotated within the peridental space without causing any injury to the root surface in the form of resorption.

3. Because of the form of the teeth rotated, somewhat corresponding to tooth forms in general, root resorption occurred in almost every case.

4. With the appliances used in the present experiments the teeth were also more or less tipped during rotation.

5. A trabecular tongue-like arranged bone formation took place on the tension sides of the root. These bone lamellae are transformed and smoothed out according to the new position of the tooth during the period of retention.

6. Cellular cementum is deposited in a marked degree on the tension side of the root, while there is none or little cementum formed on the pressure side.

7. Relapse after tooth rotation is due to the lack of functional balance between new and old tissue, and—besides the role played by the tissue fluid and the transformation of the fibers—is influenced by a sort of elastic contraction of the subepithelial tissue. This elastic force exerted by the soft tissue

may be sufficient to cause changes in the bone picture created during the preceding period of rotation.

8. In order to avoid jiggling, sufficient stable appliances with the correct amount of anchorage should be used.

9. And from the viewpoint of mechanics, intermittent force or a continuous force, followed by rest periods, should be applied to avoid root resorption and to allow the surrounding tissue to become transformed.

The Extraction of the Six-Year Molar During Childhood: By Guttorm Toverud, Oslo, Norway, *Den. Norske Tannl. Tid.* **50**: 28 (Jan.) 1940.

Again we find the extraction of the six-year molars in school children as a topic of discussion, this time by Toverud of Oslo, Norway, whose writings are well known in America. When it becomes necessary to extract the six-year molar on account of severe caries, the following points should be considered if the immediate extraction of the tooth is not absolutely indicated:

1. The efficiency of mastication after extraction.
2. The height of the bite after extraction.
3. The control of the occlusion during the period when the deciduous teeth are shed.
4. Maintenance of jaw growth and occlusion of the remaining teeth.

According to Toverud, extraction should be postponed until after the eruption of the premolars and second molars is complete. For economic reasons, he states, it would be a greater advantage if the highly defective tooth could be removed earlier. Practical experience, says Toverud, has proved that extraction may be performed at the age of ten without any bad effect on the eventual occlusion of the teeth. "During the first three to four years after extraction the occlusion will as a rule be more or less unfavorable, but during the growth and eruption of the wisdom teeth the previously formed spaces will close again and the unfavorable inclination of the second molar will be neutralized. Supposing in neutroclusion all the four first molars are extracted, the insignificant disturbance of the growth of the jaws which may occur when these teeth are removed so early will practically not be noticeable."

It is surprising to find Toverud making such statements. This reviewer has correlated close to two thousand cases of boys and girls between 15 to 19 years of age who had lost from one to all four of their first molar teeth. The most striking effect of loss of the six-year molar before it erupts, is that the unerupted tooth crown seems to find a path of least resistance through the vacant alveolus left by the roots of the extracted first molar. The second premolar seems to fall into this rarefied area and erupts distal to its usual place in the jaw. The space left by the extracted first molar is thus partly occupied by the newly erupted second premolar while a new space is created between the first and second premolars.

When first molars are extracted, the occlusion is unfavorable not only during the first three to four years, as stated by Toverud, but becomes progressively worse as the child grows older. In no case has this reviewer found

the unfavorable inclination of the second molar to become neutralized. To the contrary, pocket formation found on the mesial radicular surface and the constant trauma of the occluding teeth may eventually denude these teeth of much of their alveolar investing bone. The following is quoted from the summary furnished by the reviewer to *Dental Caries,* published by the Committee on Research of the American Dental Association (1939):

"Harmful effects following extraction of first permanent molars, are well defined in adolescent boys and girls nearing final stages of growth and development; second molars do not come forward alone to occupy the spaces left by extraction of first molars; general disturbance in occlusion ensues. The younger the child, when a first permanent molar is extracted, the greater the harmful effects on occlusion and the higher the incidence of caries. In mouths from which first permanent molars were extracted, the intensification in the average number of 'exteeth'* was more pronounced in the maxilla than in the mandible, regardless as to whether the extraction had occurred in the mandible or the maxilla or both. In children between 15 and 19 years of age, there is concomitant increase in incidence of 'exteeth,' this increase showing high degree of correlation with increase in number of lost first molars. A child with one to four first permanent molars filled or carious shows an increase in incidence of caries in the mouth as a whole corresponding with increase of fillings or caries in his first permanent molars. Incidence of caries is intensified, after extraction of any first molar, and becomes cumulative with each succeeding extraction of a first molar. Owing to individual factors, spaces left after extraction of first permanent molars do not close uniformly in all cases, doing so faster in the maxilla than in the mandible. Maxillary second molars show comparatively greater amounts of change in position than maxillary second premolars or mandibular second molars. Mandibular second premolars and second molars show close relationships in amounts of change of position at various intervals after extraction of first molars. Effects of first-molar extractions are manifested in increase in caries, occlusal disturbances, changes in facial contour and appearance, and frequently also in interference with speech, general physical growth, and development. Provision should be made in all cases where first molars must be extracted for the retention of the space after the extraction of first permanent molar teeth or, if more desirable, the closure of the space should be accomplished by controlled effort."

Book Reviews

Labio-Lingual Technic: A description of the labial and lingual appliances in the treatment of malocclusion. By O. A. Oliver, Russell E. Irish, and Claude R. Wood. Pp. 424 with 278 illustrations, Price $10, St. Louis, 1940, The C. V. Mosby Co.

This work is well timed and fills a long-felt need. The material is presented in great detail and follows an extremely orderly arrangement. The fundamentals and methods of procedure to be followed in the construction of labial and lingual appliances are given from a practical and logical point of

*Teeth which have acquired some physical defect since their eruption.

view. It is not only important to tell *how* a definite technic should be performed, it is also necessary to *show* how. This extremely difficult accomplishment is overcome by means of the many interesting and clear-cut illustrations. The book is so copiously illustrated that the material presented in the text is really of secondary importance although it is reliable throughout and complete.

This book could be adopted as a textbook in any orthodontic course teaching the labio-lingual technic. The best proof of the practicability of the theory underlying the appliances described in this book has been illustrated in the exhibit presented by the authors at recent meetings of the American Dental Association. The general make-up of the book is in keeping with recent trends which call for a definite practical presentation of technical subjects. There are no words wasted in the description of the various procedures. Whether or not one follows the labio-lingual technic in toto, it is safe to say he will, nevertheless, find much of interest in this work.

George S. Callaway, D.D.S.

Stedman's Medical Dictionary With Etymologic and Orthographic Rules: Ed. 14. Illustrated. Revised. Price $7.50, Baltimore, 1940, The Williams and Wilkins Co.

The present edition, the fourteenth, was begun by Dr. Thomas Lathrop Stedman in collaboration with the present editor, Dr. Stanley Thomas Garber, who completed the work after Dr. Stedman's death in 1938. Many new titles and subtitles have been added, including numerous recently isolated hormones, vitamins, and chemical compounds of therapeutic value. Changes in the U. S. Pharmacopoeia, eleventh edition, are included as are the new British anatomic terms, together with their Basle Anatomical Nomenclature equivalents. The pronunciation and derivation of dental, medical and other scientific terms are to be found as well as many tables. Dentists should have a medical dictionary always at hand so that they may be able to follow accurately both dental and related scientific literature.

Textbook of Physiology: By William D. Zoethout, Ph.D., Professor of Physiology in Chicago College of Dental Surgery, and W. W. Tuttle, Ph.D., Professor of Physiology, College of Medicine, State University of Iowa. Ed. 7, With 302 Illustrations. Pp. 743, Price $4.50, St. Louis, 1940, The C. V. Mosby Co.

Because of the generic dynamic quality of the subject, texts on physiology must be revised at frequent intervals and viewpoints changed as the accumulation of new facts grows. This work is intended for those having a limited length of time for the acquisition of a basic knowledge of physiology. The physiology of the teeth, mastication, growth, and metabolism are discussed in a concise and clear manner. The descriptions and illustrations are simple and understandable. Of especial interest to orthodontists will be the discussions on the physiology of the bones and muscles. A glossary and complete index are provided.

Child Psychology for Professional Workers: By Florence M. Teagarden, Ph.D. Professor of Psychology, University of Pittsburgh. Pp. 641. Cloth, Price $3.25, New York, 1940, Prentice-Hall, Inc.

Within the past few years there have appeared in medical literature repeated signs of the fact that treatment of diseases and abnormalities cannot be successfully accomplished by rule of thumb by following impersonal therapeutics based on the etiology and diagnosis of disease per se. In short it is necessary to take into consideration the additional element of personality of our patient if our therapeutic measures are to meet with success. Orthodontists are becoming more and more aware of the fact that an understanding of the psychology of handling the child is as great a factor in treating dentofacial abnormalities as is the understanding of the application of appliance therapy and of the biologic entailments of orthodontic practice.

While the entire subject of child psychology should be of great value and interest to orthodontists whose patients are mostly children, the author of this work discusses certain phases of the subject which have a direct bearing on treatment. The chapter on heredity is written in a manner which presents present knowledge without any preconcerned prejudices.

Concerning fear, one of the basic emotions in children that orthodontists have to overcome, the author says: "Most children get over fears more quickly and develop a more wholesome attitude toward life if their fears are given considerate recognition by adults. Since *suddenness* and *unexpectedness* seem to be potent fear-producing situations, a little cleverness on the part of adults will help much in preparing a child for the unusual. Sometimes a preliminary-explanation or a little preliminary practice together with a word of reassurance will get far toward preventing the building up of a fear in the first place."

Teagarden gives two basic requirements for the successful handling of children, (1) *good sense* and (2) the ability to feel oneself into another person's situation. She gives eleven rules as a guide in achieving these objectives. The book has complete bibliographic references appended to each chapter and an excellent index.

An Introduction to Sociology and Social Problems: By Deborah Mac Lurg Jensen, R.N., B.Sc. Social Service Consultant to the Visiting Nurse Association, St. Louis; Lecturer in Nursing Education, Washington University. Pp. 341. Cloth. Price $2.75, St. Louis, 1939, The C. V. Mosby Co.

While dentistry may have too long ignored the social aspect of practice, general sociologic developments in the last few years have made a definite impact on dental education as well as on dental practice. We are no longer to feel that the privilege to practice dentistry is given us solely to guarantee us the right to make a living, nor are we to continue to believe that the ability to pay for service is to be the sole determining factor as to whether the patient will receive such service. Government, social workers, and other interested sources are taking it on themselves to extend the provision of health care regardless of the ability of the recipient to pay for such care. It should be the

prime concern of professional men, in view of these sociologic developments, to acquaint themselves with the viewpoint of the social worker and to become familiar with the methods by which social doctrines are propagated.

Chapters are provided on "Man's Social Nature and the Development of Personality"; "Collective Behavior"; "The Community"; "The Family and Social Change."

While the book is primarily written for nurses, it will be found exceedingly interesting by those who are unfamiliar, but nevertheless concerned, with social problems confronting the community and the professional man alike.

Editorial

The following is a comment of Dr. C. C. Howard, of Atlanta, Ga., pertaining to an editorial which appeared in the April issue of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY entitled, "Limitations of Treatment." The comments of Dr. Howard are being published for the reason that he has appeared before the American Association of Orthodontists and various other organizations in the past on the subject of limitations of treatment and orthodontic growth problems. It is thought his comment is of interest to the readers of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY.

EDITOR.

Comments on "Limitations of Treatment"

BY CLINTON C. HOWARD

THE general theme of the editorial—"Limitations of Treatment"—appearing in the April issue of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY should arouse an interest in a more careful analysis of orthodontic growth problems. My interest is not so great in the perverted skeletal growth of the acromegalic individual as it is in the capability of our specialty to recognize signs and symptoms of such an anomaly *in its incipiency*.

In 1936, at the annual session of the American Association of Orthodontists, it was my privilege to present material which dealt with the growth hormone etiology of certain Class III cases. The effect upon the growth of the mandib' and extremities is quite similar to that which is produced by hormones of the classical acromegalic type. Quotations from this article* should serve to point the way to a recognition of accelerated mandibular growth at an early age. After discussing dwarfism and gigantism, the article continues:

"Other cases, the ones which constitute a genuine problem to the orthodontists, will present a definite overgrowth of the mandible. I have chosen to designate such anomalies as the spacing of teeth and overgrowth of the mandible as *acromegaloid* manifestations. This coined term implies that these individuals suggest the condition of acromegaly; both result from an excessive influence of the growth hormone. The characteristic skeletal anomalies of acromegaly are lacking in degree, but the jaw and arch features, while varying in extent, are strikingly similar. These malgrowth problems are incorrectible by means of orthodontic mechanical stimulation. The potency of the growth impulse activated by hormone stimulation cannot be completely overcome by mechanical stimulation. My own experience with orthodontic problems of this type shows that, even though they are incorrectible as far as changing the shape and conformation of the mandible, still mechanical stimulation serves as a combating influence to hormone stimulation and, therefore, is valuable in preventing a magnified anomaly. . . .

*Acromegaloid Growth and Dwarfism, INT. J. ORTHODONTIA 22: 992, 1936.

"In discussing these cases with particular reference to their etiology, I am introducing an entirely *new concept* which has not heretofore been made a part of medical or orthodontic literature. . . .

"Although the evidence . . . strongly points to gigantism as being a *potential* acromegaloid growth perversion, *gigantism is not the determining factor.* There appears to be some *connection between acromegaloid growth characteristics and the early union of epiphyses with their parent bones.* . . . The acromegaloid mandibular case occurs during the growing stage, while acromegaly occurs after epiphyseal union, or after the termination of skeletal growth."

It is fortunate that acromegaloid imbalances are relatively rare. If they represented the majority of orthodontic problems, our specialty would have little to offer. As a matter of fact, *all growth problems* resulting in malocclusion of the human teeth are poorly understood. In the light of newer knowledge, we shall be obliged to think of a possible nutritional influence in conjunction with the hormone influence, without losing sight of genetic predispositions.

Correspondence

An editorial appeared in the December, 1939, issue of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY entitled, "School Hours and Professional Service for Children." On account of the voluminous correspondence which has been inspired by the appearance of this editorial, also on account of its distribution as a reprint by the Bureau of Information of the American Association of Orthodontists, it becomes obvious that the subject discussed has unusually wide interest among orthodontists. As a result of this correspondence it has been interesting to note the reaction from various parts of the United States, also to note the subject has been a matter for controversy in a great many localities between dentists and school authorities. On account of the subject in itself causing such wide interest, the following is an open letter to the Editor written by Dr. Francis W. Nash, D.D.S., of Scranton, Pa.

EDITOR.

AN OPEN LETTER TO THE EDITOR OF THE AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY

In December you published an editorial on the subject "School Hours and Professional Service for School Children." This matter, it seems to me, is an extremely important one, and the time is upon us when it should be mentioned again in order to stir up interest in it. For that reason I am recounting a little history concerning my personal efforts here in Pennsylvania.

In the interest of giving details I quote below from a letter I wrote to the Chief of the Dental Division of the Pennsylvania State Department of Health on the subject and the reply received from him:

Dear Doctor:

> . . . The present President (Pennsylvania State Dental Society) . . . decided it was a local matter. It is a local matter in some respects, but looked at in a larger way, it is a state-wide matter, and as far as that is concerned, it is even a national dental matter. Confining my efforts to reform in this matter to the state only, I feel that a change in the present regulation which will encourage school authorities to allow children to be dismissed for dental appointments without prejudice of any sort is a desirable end.
>
> Among the reasons which cause men to forego the pleasure of children's dentistry, as you undoubtedly know, are that the dentist is tired at four o'clock or thereabouts; Saturday mornings he may feel all right but is casting longing eyes at the green fields when afternoon arrives; the child, both after school and on Saturdays, has other plans and other interests, and is not in most instances, in a mood for co-operation.

I am burdening you with all of this because in your position you may be able to do something about it. It involves no change in the school code, but simply a change in a bureaucratic order which was undoubtedly written by some children's expert who is, within his person and without, unaware of the valuable health service dentistry has to offer. Children are excused from school without any question for eye examinations, tonsillectomies, slight colds, etc., all of which is as it should be, but dentistry should be placed in a similar position.

There is no personal interest involved in this because more than eleven years ago I arranged with the superintendent of schools here that my appointment cards would be honored, and this has been done. In other words, I am not having any trouble in getting children out of school for orthodontic treatment.

Reply:

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF HEALTH
HARRISBURG

Dear Dr. Nash:

. . . relative to securing better cooperation of the school authorities in releasing children for dental appointments.

I believe . . . this is really a local matter. The regulation which you quote relative to excusing pupils from school to have dental work done is sufficiently broad to permit the local authorities to cooperate completely with the dentists if they so desire. I do not think that I can do any good by taking this matter up at this time.

I did consult with the principal of the High School in Germantown. We have very little difficulty down there, in securing the excuses for pupils to have dental work provided they are up with their school work. When we do have trouble, we have always been able to straighten the matter out by making a personal appeal for the individual case involved.

If a specific instance of lack of cooperation were referred to us, I believe it might be within our province to act, but as I have stated above I do not think any good can be accomplished by treating the matter as a general complaint.

Sincerely yours,

(Signed)

LINWOOD G. GRACE, D.D.S.
Chief, Dental Division

The regulations of the Department of Public Instruction of the Commonwealth of Pennsylvania "Relative to Excusing Pupils From School to Have Dental Dork Done" are as follows:

"Under ordinary circumstances dental work should be done during vacation periods, after school and on Saturday. Whether children should be excused from school to go to a dentist's office is

a question for the local superintendent to decide, provided the following conditions are met:

> "When a pupil is excused for this purpose, the time for the appointment should be so arranged as not to interfere with the program of work which the pupil is following in school. The dentist should send the teacher of the public school, or the principal, a written statement giving the exact time the child came for the appointment and the exact time he left. The parent should file a statement with the teacher or principal to the effect that the child was absent during this time for the purpose specified."

The foregoing regulation set up by a bureau is ostensibly liberal. The fact of the matter is, however, that in the hands of the uninformed individual school authority, it is interpreted as extending an extraordinary privilege to a particular child and tearing down the standard of the attendance program or schedule of the particular grade or school.

To sum up briefly, the treatment of children by dentists will never fully and properly succeed until full and proper time for carrying on such treatment is allotted in an unstinting way by all parties concerned.

It is my intention to address you further at a later date regarding attitudes that I have found among dentists on this matter; and also some other phases of it.

Very truly yours,
FRANCIS W. NASH, D.D.S.
Scranton, Pa.

May 7, 1940

Special Article

Remarks in Connection with the Presentation of the Portrait of Dr. T. Wingate Todd on Behalf of the Bolton Fund to Western Reserve University

B. Holly Broadbent, Cleveland, Ohio

The American Journal of Orthodontics and Oral Surgery prints herewith remarks made by Dr. B. Holly Broadbent of Cleveland in connection with the presentation of the portrait of Dr. T. Wingate Todd on behalf of the Bolton Fund to Western Reserve University (Jan. 15, 1940). The late Dr. Todd was an important contributor to the advance of orthodontics, particularly on account of his study of the development of the face of the growing child, which started in 1929.

Editor.

ON THIS occasion it seems appropriate to sketch briefly the relationship of the Bolton Fund to this institution and to the other foundations. The Bolton Study owes its existence to Dr. Todd's deep and keen interest in dental research and to the generosity of Mrs. Chester C. Bolton and her son, Mr. Charles Bingham Bolton.

This study of the development of the face of the growing child started in 1929, enjoyed, and continues to enjoy, the splendid facilities of the Anatomical Laboratory and the unusual opportunity of carrying on with the Brush Foundation an independent but coordinated investigation in the growth of the faces of the children in the Brush Inquiry of Developmental Health.

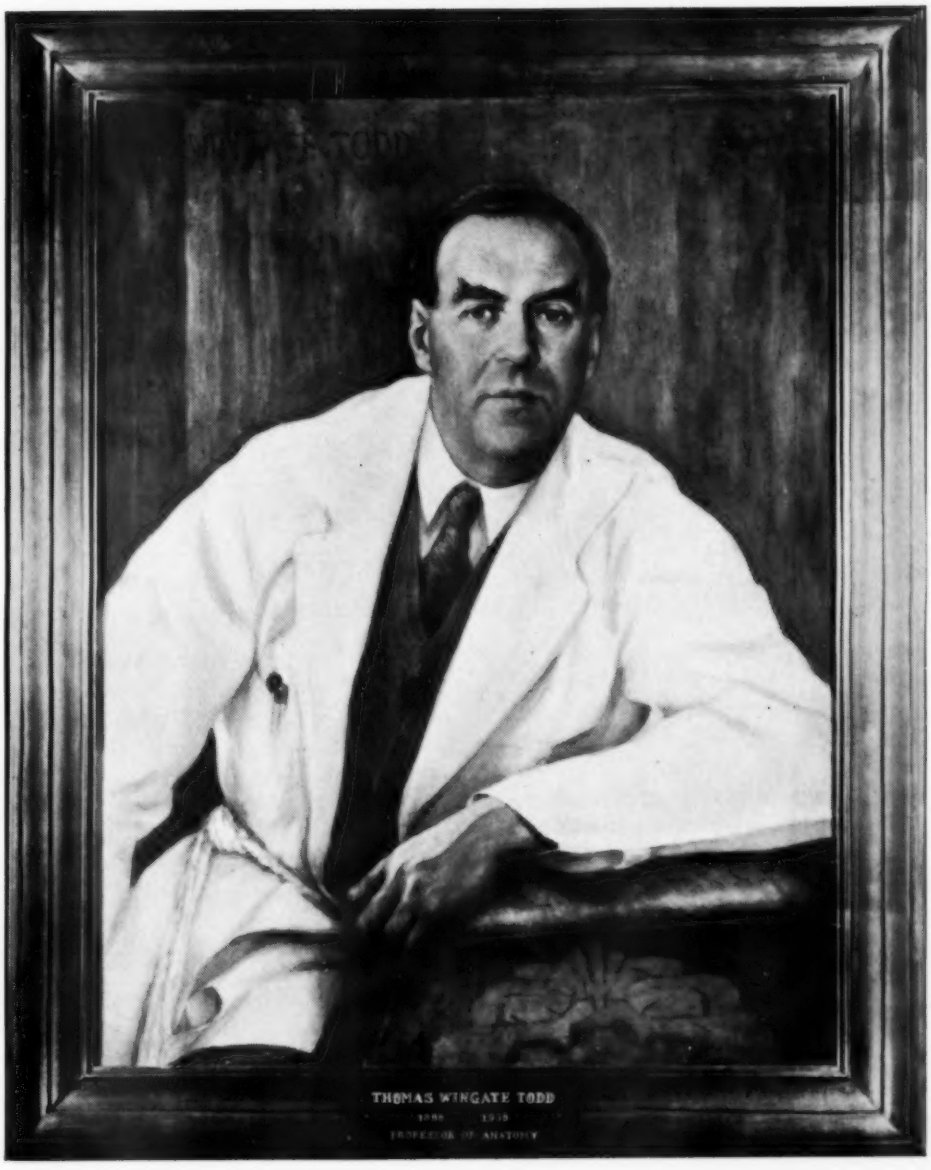
Doctor Todd's enthusiasm for dentistry antedated his coming to America. While still at Manchester, England, he set up a new curriculum for the diploma of dentistry and caused to be created a degree of Dental Science.

Accepting the call of Cleveland's University when he was not yet 30 years old, he continued to champion the cause of dentistry in this medical school.

In his courses in gross anatomy he instructed the students of dentistry on the same basis as the medical students. His lecture course on Comparative Dental Anatomy led to the publication of his book on *Mammalian Dentition* through which he became recognized as an outstanding authority in this field.

Coupled with his genius to inspire and recruit co-workers, he had the rare ability to enlist local financial backing which in turn attracted support of national foundations. He was among the first to insist that anatomy should be a living rather than a "dead house" study, and it is interesting to note that this view is now gaining worldwide acceptance.

Largely through his efforts, the tooth-straightening branch of dentistry known as orthodontics received a fresh vision and a new light, tremendously expanding its scope and usefulness.


THOMAS WINGATE TODD
1888 1938
PROFESSOR OF ANATOMY

As a person, Dr. Todd was deeply loved by his colleagues and co-workers, not only for his scientific attainments but also for his sparkling and delightful personality.

We are much the debtors to Dr. Erich von Baeyer whose brush has so accurately portrayed such a generous measure of this dynamic man.

And now, President Leutner, it is my privilege, on behalf of the Bolton Fund, to present to Western Reserve University, this portrait of Dr. T. Wingate Todd, whose outstanding contributions to medical and dental science have brought glory to Reserve, and whose achievements in the field of child health and development have focused worldwide attention on her School of Medicine. It is a portrait of a truly great scientist who devoted his life to the welfare of the child in the interests of our nation.

News and Notes

A. D. A. to Meet in Cleveland

"The Centennial of American Dentistry" was the slogan adopted by the Board of Trustees as the theme for the meeting of the American Dental Association in Cleveland, Sept. 9 to 13, 1940. In significant recognition of the pioneers in dental science, literature, education, and organization, and as a tribute to the Dental Centenary Celebration Committee in Baltimore, who have made it possible to commemorate the achievements of these Pioneers, an historical exhibit shall be held in the Public Auditorium of Cleveland.

The Local Arrangements Committee is especially desirous that the 1940 meeting keep faith with those instincts which have brought dentistry to its present enviable position. The Cleveland Public Auditorium, which is the largest in the country, will be utilized to capacity to house the exhibits and scientific sessions, clinics, lectures, and demonstrations. All of the facilities pertinent to the conduct of the meeting are within easy walking distance of the leading hotels.

R. E. CREIG, Chairman,
Local Arrangements Committee
Publicity Committee

Tenth Meeting of the Biological Photographic Association

The tenth annual convention of the Biological Photographic Association will be held at the Hotel Schroeder, Milwaukee, Wis., Sept. 12, 13, and 14. This society is interested in the further study of photography as applied to the biologic sciences, and the improvement of its technique. Scientific photographers from all parts of the country will meet to exchange ideas and information on still and motion picture photography as well as the latest developments in color work. Formal papers will be presented outlining new methods of technique, and there will be informal round table discussions which will be especially instructive. Commercial firms specializing in the manufacture of scientific photographic apparatus and materials will exhibit and explain the use of their products. A salon consisting of natural color and monochrome prints of biologic and clinical subjects will illustrate a very fine degree of perfection in biologic photography.

Notes of Interest

Dr. Charles S. Jonas announces the opening of his office for the exclusive practice of orthodontics at Medical Sciences Building, 101 South Indiana Avenue, Atlantic City, N. J.

Dr. John W. Richmond announces that his practice is now limited to orthodontics. Offices at 1008 Huron Building, Kansas City, Kan., and suburban office at 5824 Reeds Road, Johnson County, Kan.

Dr. J. E. Harding, formerly of Paris, France, wishes to announce the opening of his offices at 8029 Forsythe Blvd., St. Louis, Mo.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, William A. Murray - - - - - - - - - - - - - - - - - - Evanston, Ill.
Secretary-Treasurer, Claude R. Wood - - - - - - - - - - - - - Knoxville, Tenn.
Public Relations Bureau Director, Dwight Anderson
- - - - - - - - - - - - - - - - - - 2 East 103rd St., New York, N. Y.

Central Association of Orthodontists

President, Harold J. Noyes - - - - - - - - - - - - - - - - - - St. Paul, Minn.
Secretary-Treasurer, L. B. Higley - - - - - - - - - - - - - - - Iowa City, Iowa

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President, Harvey G. Bean - - - - - - - - - - - - - - - - - - Toronto, Can.
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President, I. D. Davis - Boston, Mass.
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Rocky Mountain Society of Orthodontists

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President, G. C. Turner - Lubbock, Texas
Secretary-Treasurer, R. E. Olson - - - - - - - - - - - - - - - - Wichita, Kan.

Washington-Baltimore Society of Orthodontists

President, B. E. Erikson - - - - - - - - - - - - - - - - - - - Washington, D. C.
Secretary-Treasurer, Stephen C. Hopkins - - - - - - - - - - - - Washington, D. C.

American Board of Orthodontics

President, Harry E. Kelsey - - - - - - - - - - - - - - - - - - Baltimore, Md.
Secretary, Charles R. Baker - - - - - - - - - - - - - - - - - - Evanston, Ill.
Treasurer, Bernard G. DeVries - - - - - - - - - - - - - - - - - Minneapolis, Minn.
William E. Flesher - - - - - - - - - - - - - - - - - Oklahoma City, Okla.
Frederic T. Murlless, Jr. - - - - - - - - - - - - - - - - - - Hartford, Conn.
Oliver W. White - Detroit, Mich.
James D. McCoy - Los Angeles, Calif.

Foreign Societies†

British Society for the Study of Orthodontics

President, S. A. Riddett
Secretary, R. Cutler
Treasurer, Harold Chapman

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*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.